MODERN PLASTICS

SEPTEMBER 1958

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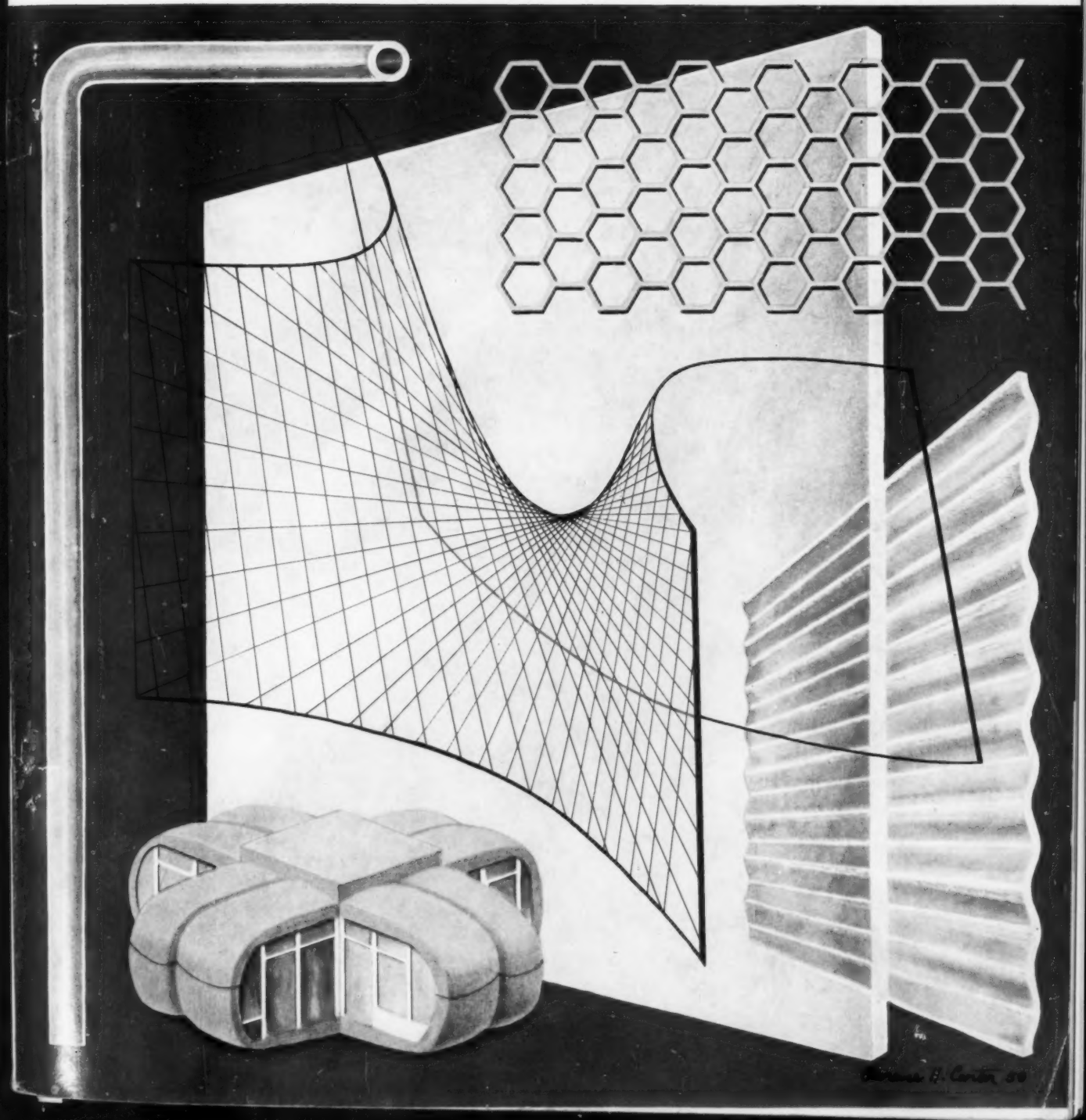

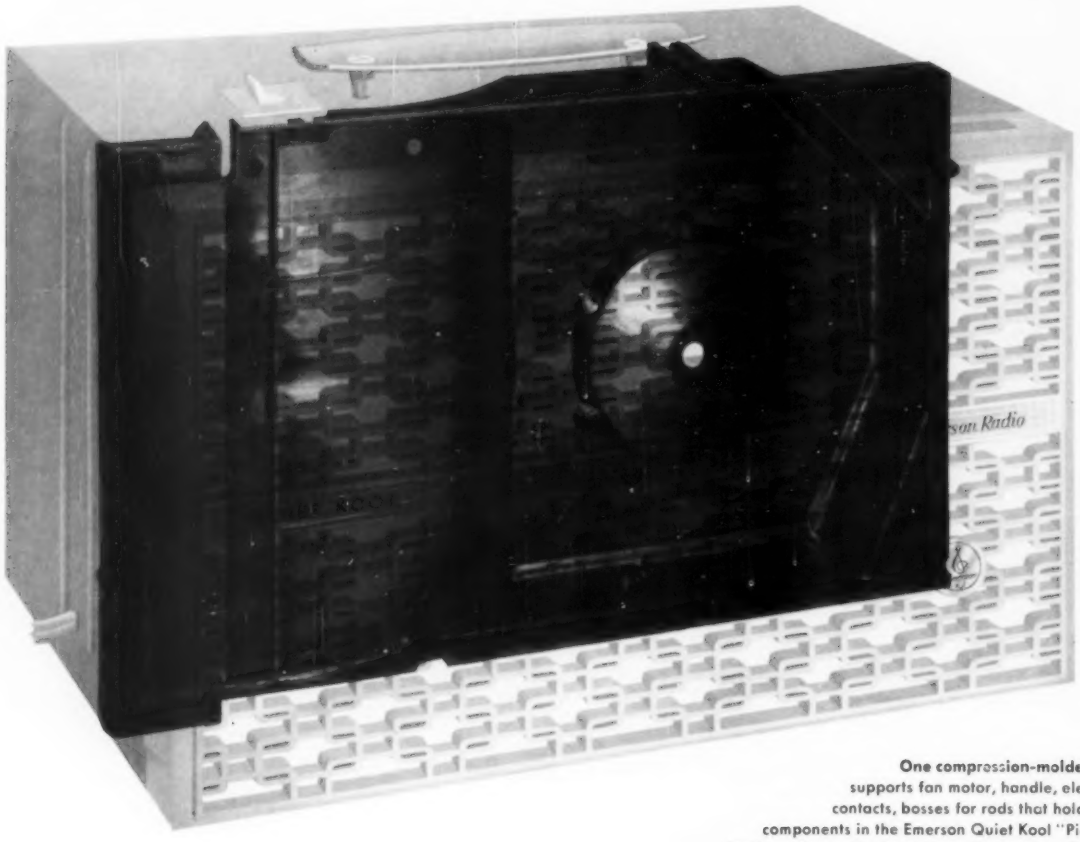

One compression-molded part supports fan motor, handle, electrical contacts, bosses for rods that hold other components in the Emerson Quiet Kool "Pick-up" Air Conditioner. Molder is Perry Plastics, Inc., Erie, Pa.

You can do something about costs with amazing new impact phenolic

Your newest weapon in the war against production costs is an amazing sisal-filled phenolic called *Durez 18683*. It gives you high impact strength at lower cost than ever before.

Using this new material, engineers of Emerson Radio and Phonograph Corporation have designed a quality portable air conditioner that sells for little more than the price of a large room fan.

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Specify 18683 for high-strength jobs such as automotive heater housings, glove compartments, instrument panels; for gears, wheels, pulleys, housings, electric motor end bells.

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DUREZ 18683 is a sisal-filled phenolic providing high impact strength at rock-bottom cost, which helps solve many high-strength molding problems from air conditioner housings to gears and pulleys.

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MODERN PLASTICS

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Another new development using

B.F.Goodrich Chemical *raw materials*

The seals shown here, made by B. F. Goodrich Canada Limited, are being placed in position on locks of the St. Lawrence Seaway, a portion of 40 miles of Geon seals for various Seaway projects.

Miles of Geon seal the Seaway

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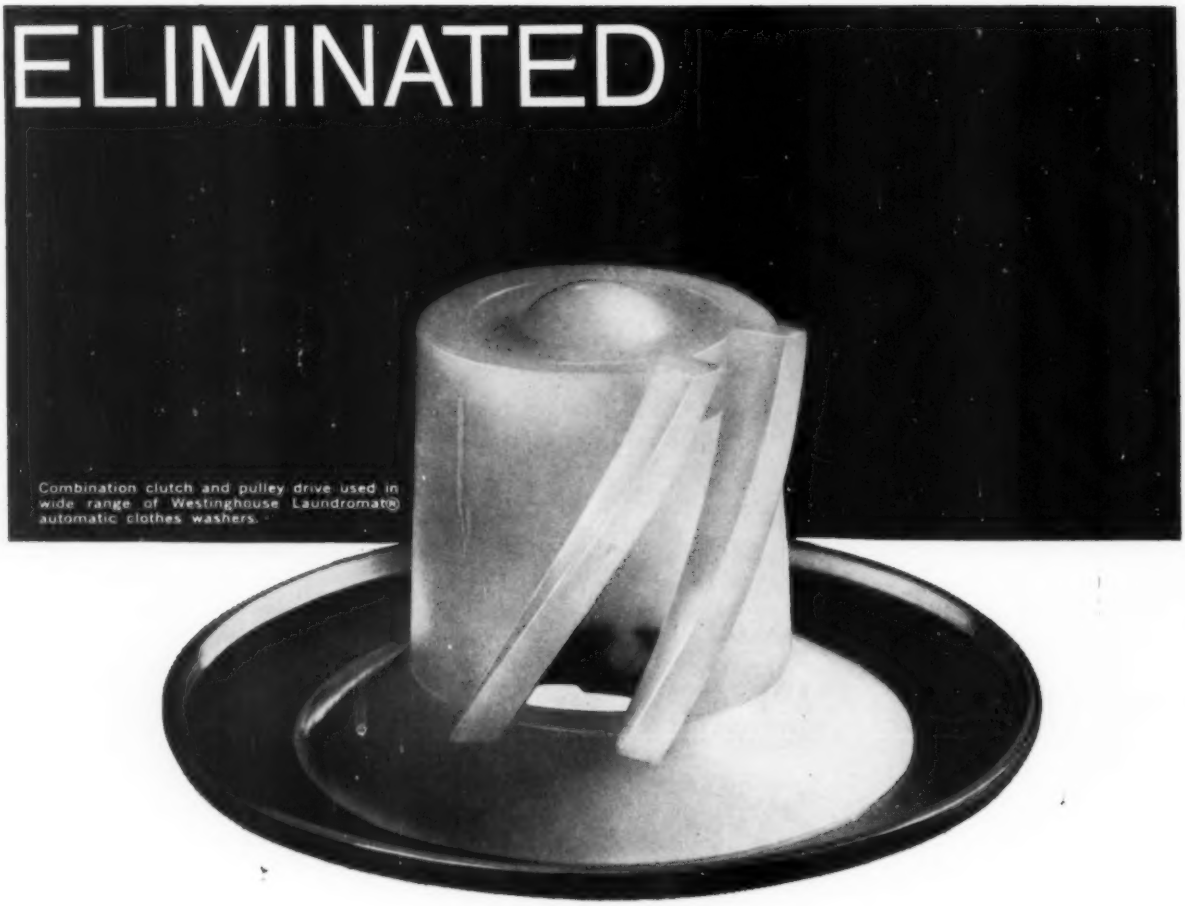

Combination clutch and pulley drive used in wide range of Westinghouse Laundromat® automatic clothes washers.

WHEN CHICAGO MOLDED SHOWS HOW NYLON CAN REPLACE METAL . . . AND MAKE A BETTER PART, FOR LESS

By coming up with an imaginative approach, Chicago Molded engineers eliminated a costly machining operation previously needed on this pulley slide when it was made of metal. The solution: a nylon body with a stamped metal insert (sheet steel, flash plated with copper).

This was no mean designing feat. Chicago Molded engineers not only had to produce a less expensive part, but recommend materials and methods that would come up to commercial standards in mass production. This included meeting close tolerances on both the internal diameter of the shaft and the slot — not easy to mold on a multiple contour shape. Another complicating factor was injection-molding around a metal insert.

Working with the Westinghouse Laundromat engineering group, Chicago Molded also came up with a versatile, flash-free mold that could be used to make two different pulley slides. This is necessary because there are *two* slide types, each with a different helical pitch (24° right and 14° left). What they did was design a multiple cavity mold that permits simultaneous production of *both types*. The secret: removable sections in the mold for changing the pitch.

The success of this design illustrates the *cost-cutting* results you get by having Chicago Molded engineers work with your people in the blueprint stages. In suggesting materials and modifications — as well as in designing molds — they can, as they did for Westinghouse, make a better product at lower cost. Perhaps that's why 66% of Chicago Molded's business comes from firms served for over 25 years.

Write today for a free subscription to Plastics Progress, Chicago Molded's data-packed magazine on up-to-date developments in plastics.

CHICAGO MOLDED
PRODUCTS CORPORATION
1046 North Kolmar Avenue, Chicago 2, Illinois

Editorial

World trade in know-how

Probably more than most industries, the plastics industries have led in the building of "world trade in ideas." Companies in Australia, Italy, Israel, Japan, and elsewhere are jointly owned by American and foreign capital and make use of know-how developed in both places.

Back of trade in ideas is, of course, trade in products and materials. And the plastics industry in the United States has a large stake in that trade since we produce more plastics raw materials than the rest of the free world combined.

In 1956—the last year for which final figures are available—the United States exported 439,360,000 lb. of plastics raw materials, and imported only 9,235,000 pounds. In the same year, the United States supplied 82.6% of all plastics raw materials exported to Central America from all parts of the world; 57.3% of all exports to South America; 43.4% of all the plastics raw materials going to the Far East; and 21.8% of all plastics raw materials supplied to Africa.

The Reciprocal Trade Program, first enacted in 1934 and since extended 10 times, has had rough going in the Congress, particularly in the Senate, this year. The House of Representatives passed the Administration's Trade Agreement Act with a majority of both parties, extended it for five years instead of the previous maximum extension of three years, and granted the President broader trade powers than before, including authority to pare tariffs. The Senate, by an overwhelming majority, voted to extend the Reciprocal Trade Agreement but would agree to only a three-year extension and allowed the President power to reduce tariffs by only 15% over a five-year period. As we go to press it looks as though the Senate-House Conference may allow a four-year extension of the program and increase the President's tariff cutting authority to 20 percent.

Whatever action is taken will affect all elements in the plastics industry, from the biggest chemical company to the smallest molder, for years to come. Fortunately, trade in ideas and know-how is quite as important to the future of plastics the world over as is trade in materials and products.

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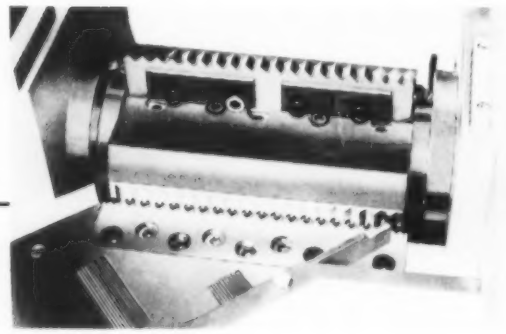

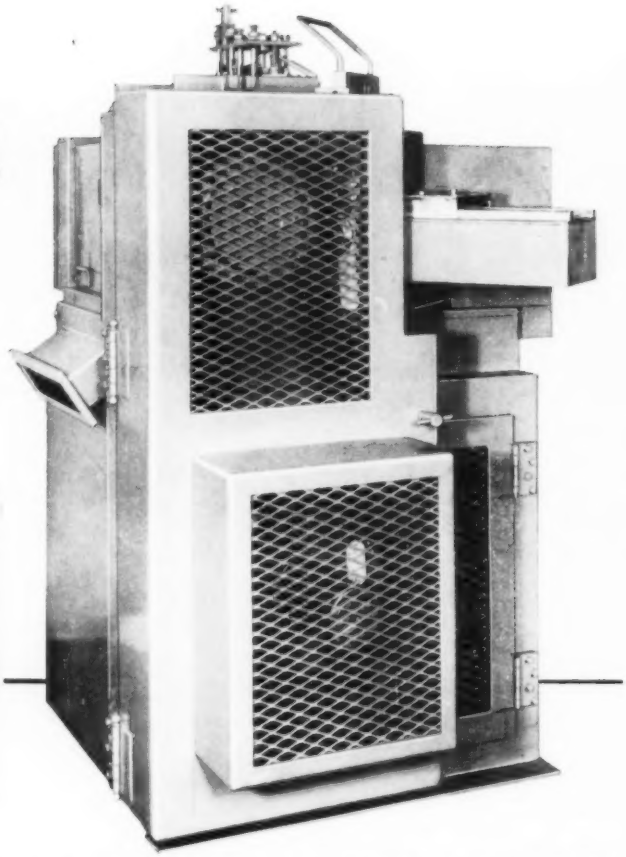

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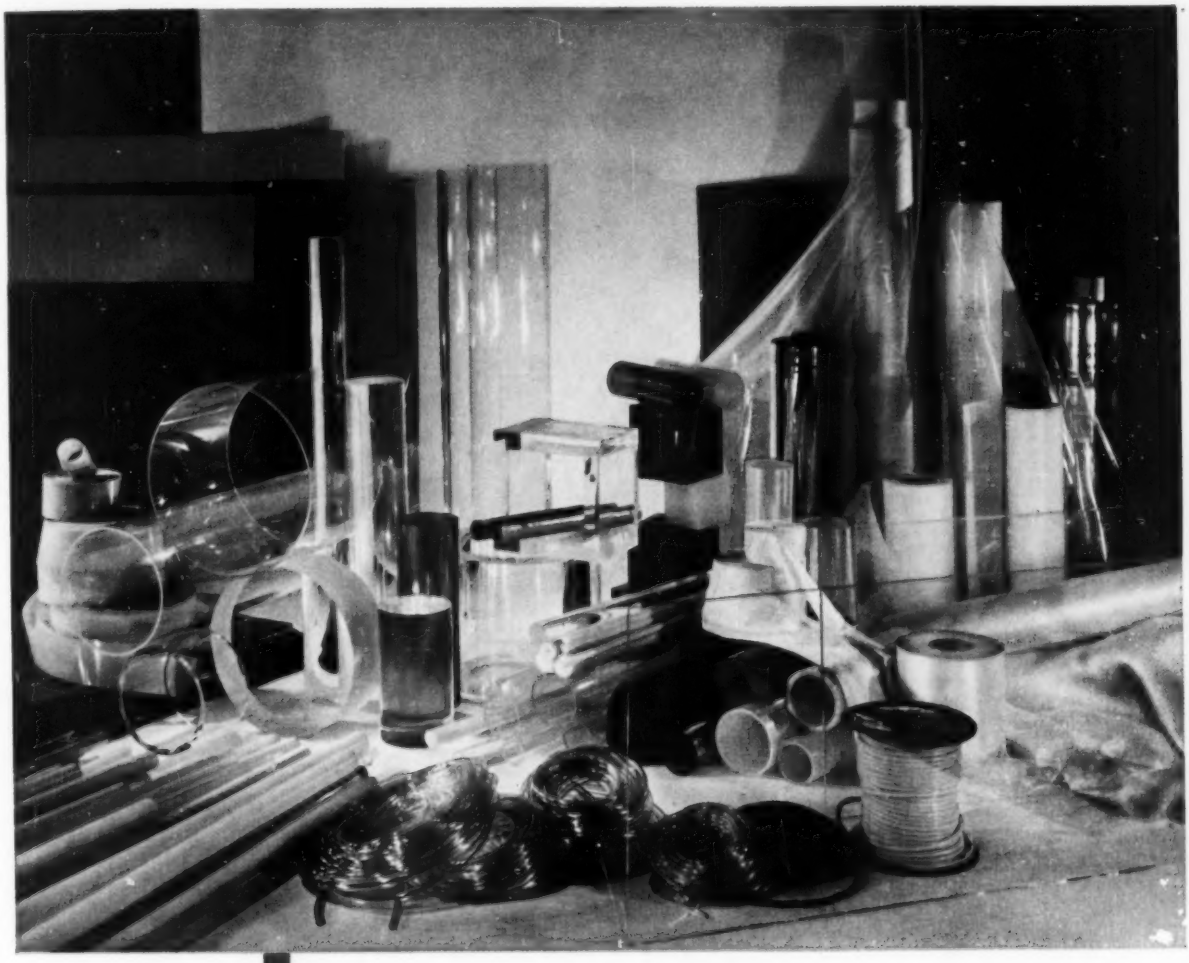

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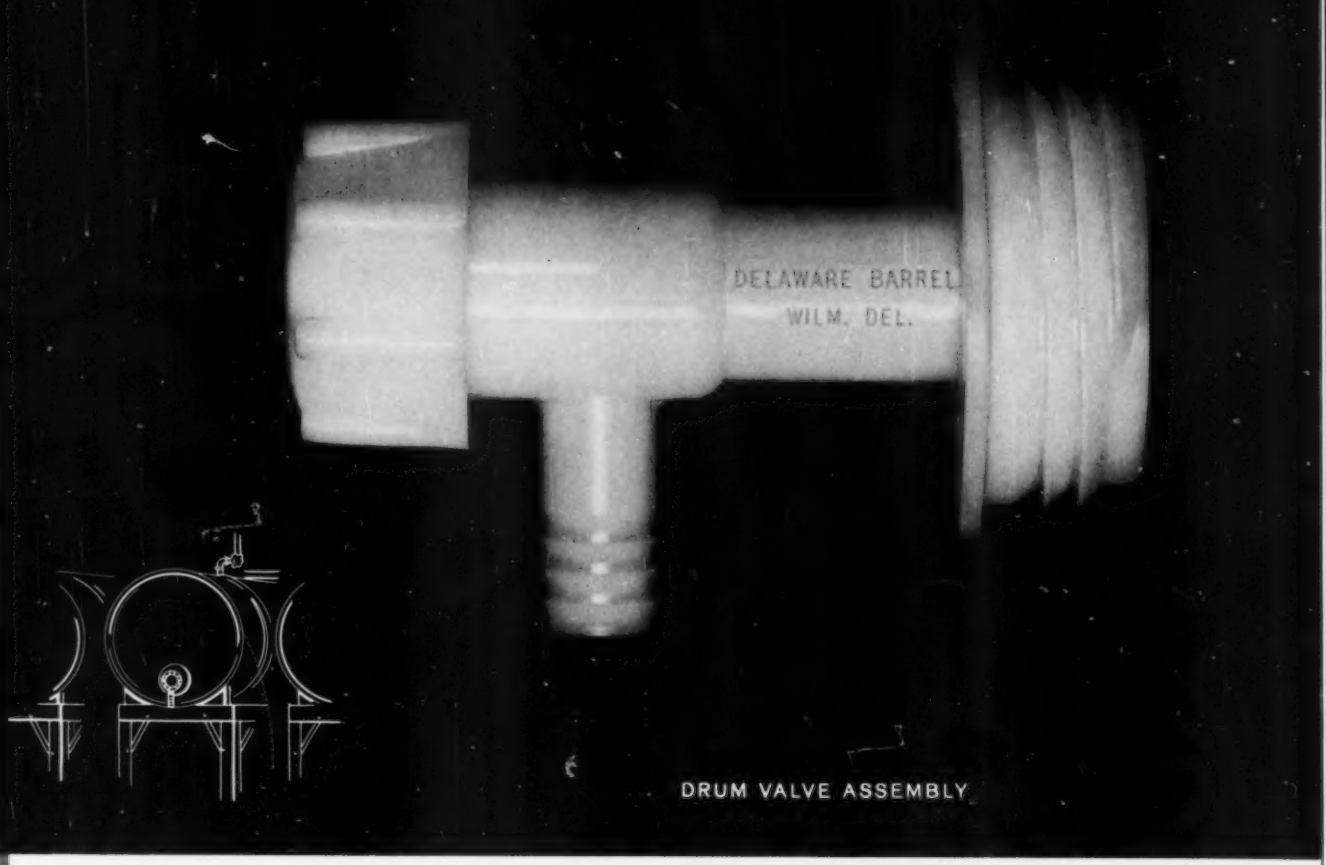

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TYPICAL PHYSICAL AND CHEMICAL PROPERTIES OF FORTIFLEX

Properties of Fortiflex "A" Related to Melt Index

PHYSICAL PROPERTIES	ASTM METHOD	UNITS	FORTIFLEX RESINS A-20	A-70	A-250	A-500
Melt Index	D-1238-52T	—	0.2	0.7	2.5	5.0
Heat Distortion Temp. (66 psi)	D-648-45T	°F.	185	185	180	180
Brittleness Temp.	D-764-52T	°F.	—200	—180	—160	—100
Impact Strength, Izod (⅛" x ½" injection-molded bars)	D-256-54T	ft. lb./in. notch	23	18	13	3
Tensile Strength, Max., 0.2 in./min.	D-638-52T	psi.	3700	3600	3500	3300
Elongation, First Tensile Yield Point	D-638-52T	%	25	25	25	25

Properties of Fortiflex "A" Not Affected by Melt Index

PHYSICAL PROPERTIES	ASTM METHOD	UNITS	VALUE
Density		g/cc.	0.96
Refractive Index	D-542-50	$N^{25}D$	1.54
Hardness, Shore D	D-676-49T		65
Stiffness	D-747-50	psi.	150,000
Water Absorption (⅛" specimen, 24 hrs. immersion @ room temp.)	D-570-54T	%, wgt. gain	<0.01
Flammability	D-635-44	in./min.	1.0

Fortiflex...a Celanese plastic

Canadian Affiliate: Canadian Chemical Co., Limited, Montreal, Toronto, Vancouver.
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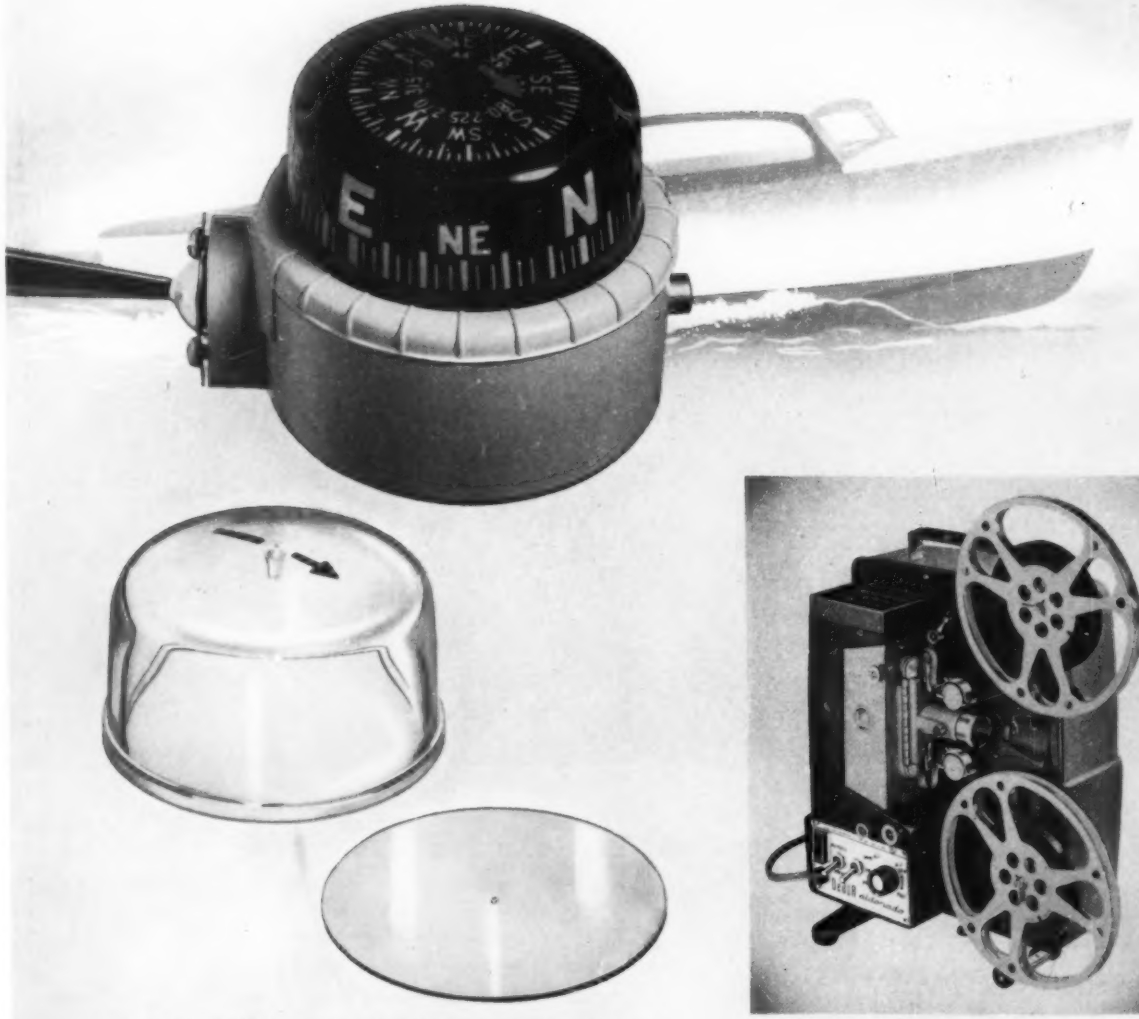

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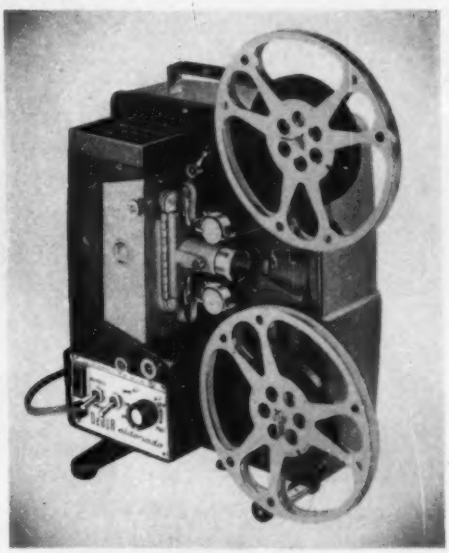

INSTRUMENT PANEL of transparent LUCITE mounted on aluminized foil makes centralized controls easy to read while projecting 8-mm. movies in darkened room, for LUCITE transmits about 92% of light striking it. Available in a wide range of transparent, translucent and opaque colors, LUCITE is economically molded to close tolerances. (Panel molded for deJur Amsco Corporation, Long Island City, N. Y., by Jamison Plastics Corp., North Bellmore, N. Y.)

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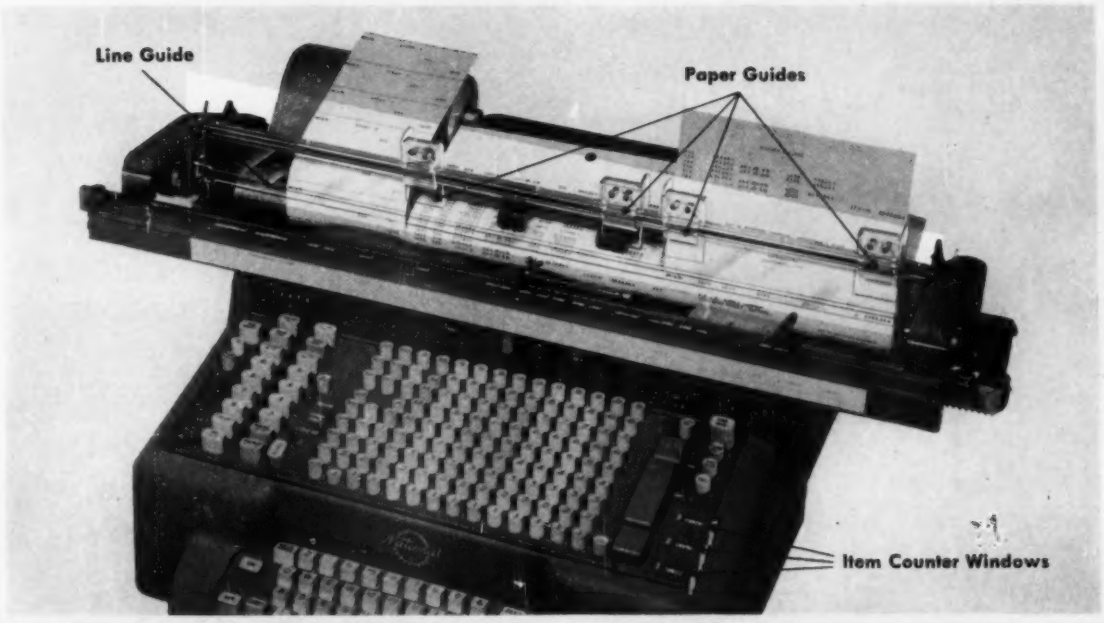

LINE GUIDE, PAPER GUIDES, and **ITEM COUNTER WINDOWS** on NCR accounting machine are molded of LUCITE acrylic resin to provide better visual control. Operator can see previous and present postings, which increases accuracy, insures correct form alignment, simplifies posting procedure and permits sight-audit of all entries and balances picked up. (Parts of LUCITE manufactured by Molding Section of The National Cash Register Company, Dayton, Ohio.)

MOTORCYCLE MEDALLION of LUCITE has a three-dimensional effect achieved through back-painting in gold, silver and black. This beautiful emblem is visible for great distances, and its optical properties will not be affected by age, sunlight or moisture. Because LUCITE has remarkable weather resistance, the medallion will maintain its color and appearance through years of outdoor exposure. (Molded for Harley-Davidson Motor Co., Milwaukee, Wis., by Gits Molding Corporation, Chicago, Ill.)

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Before production starts, the color and composition of every run of saturating paper are checked by actually laminating samples on special press equipment in our quality control laboratory.

Photo courtesy United Plastics & Development Co., Kent, Ohio

New—and worthy of note!

What makes the cone-shaped markers pictured above worthy of note is that they're made of a vinyl plastisol.

The advantages are obvious: Higher strength and lighter weight; greater resistance to water, oils, greases and tars; easier cleaning; translucency for internal lighting; and brighter colors that won't fade, chip, scuff or rub off.

The plastisol used in making these cones is based on a blend of PLIOVIC resins—Goodyear's new PLIOVIC VO, low temperature fusing PLIOVIC AO, and viscosity stabilizing PLIOVIC S50.

The major advantages in using this three-way PLIOVIC blend lie in fast and complete fusion of thick sections at moderate temperature, and balanced flow with a minimum of plasticizer. This eliminates exudation and greatly reduces pigment discoloration. Other advantages include: Ease of mixing. Faithful mold reproduction. Good hot-tear strength. And excellent physical properties. For full details, including the latest *Tech Book Bulletins*, just write:

Goodyear, Chemical Division
Dept. U-9422, Akron 16, Ohio.

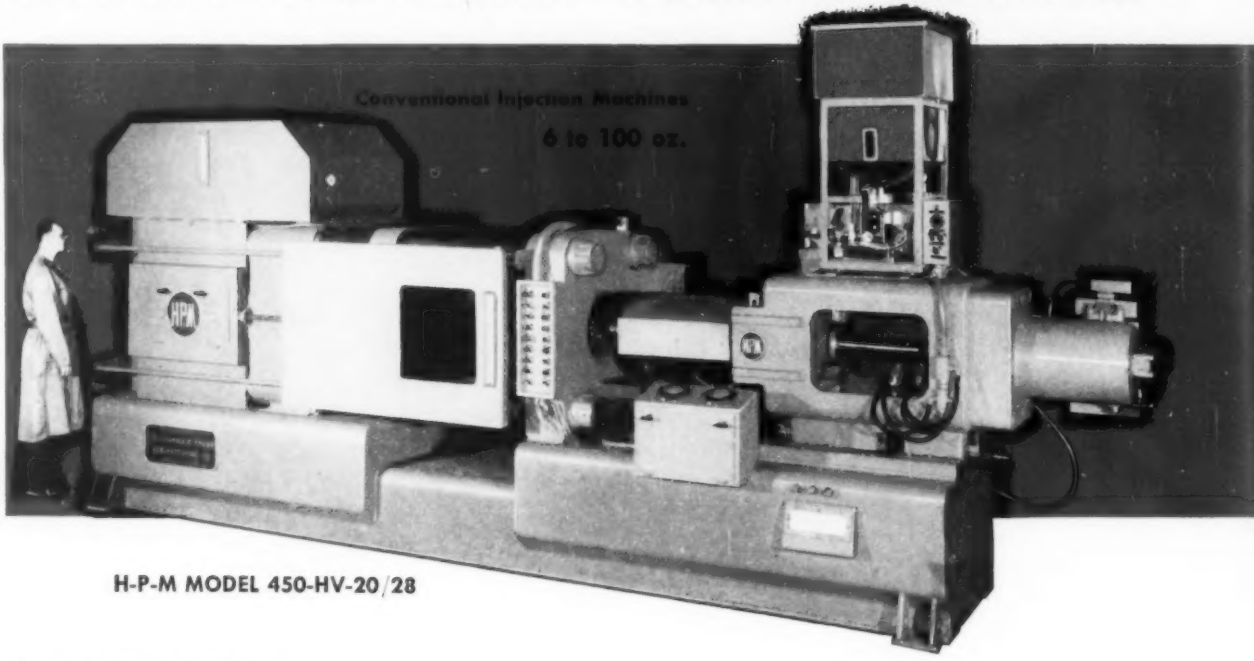
GOODYEAR

CHEMICAL DIVISION

Pliovic—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

THERE'S AN HPM FOR

INJECTION—COMPRESSION—TRANSFER—LAMINATING—



H-P-M MODEL 450-HV-20/28

- **Full Hydraulic Mold Clamp**
- **Large Platens With Plenty of Stroke and Daylight**
- **Over-Capacity Heating Cylinders**
- **Greater Horsepower With Faster Injection Speeds**
- **Manifold Valve System Reduces Hydraulic Piping**
- **Overhead Oil Tank**
- **New Hydraulic System Incorporating Flange Mounted Heavy-duty Pumps**

Choose the method best suited to your needs, then select an H-P-M press to do the job! A pioneer in the manufacture of plastic molding machinery, H-P-M offers plastics machines for every application—injection, compression, transfer, laminating and reinforced plastics—machines designed to meet the most exacting demands of modern plastic molding. There's an H-P-M plastics engineer as near as your telephone—call him today.

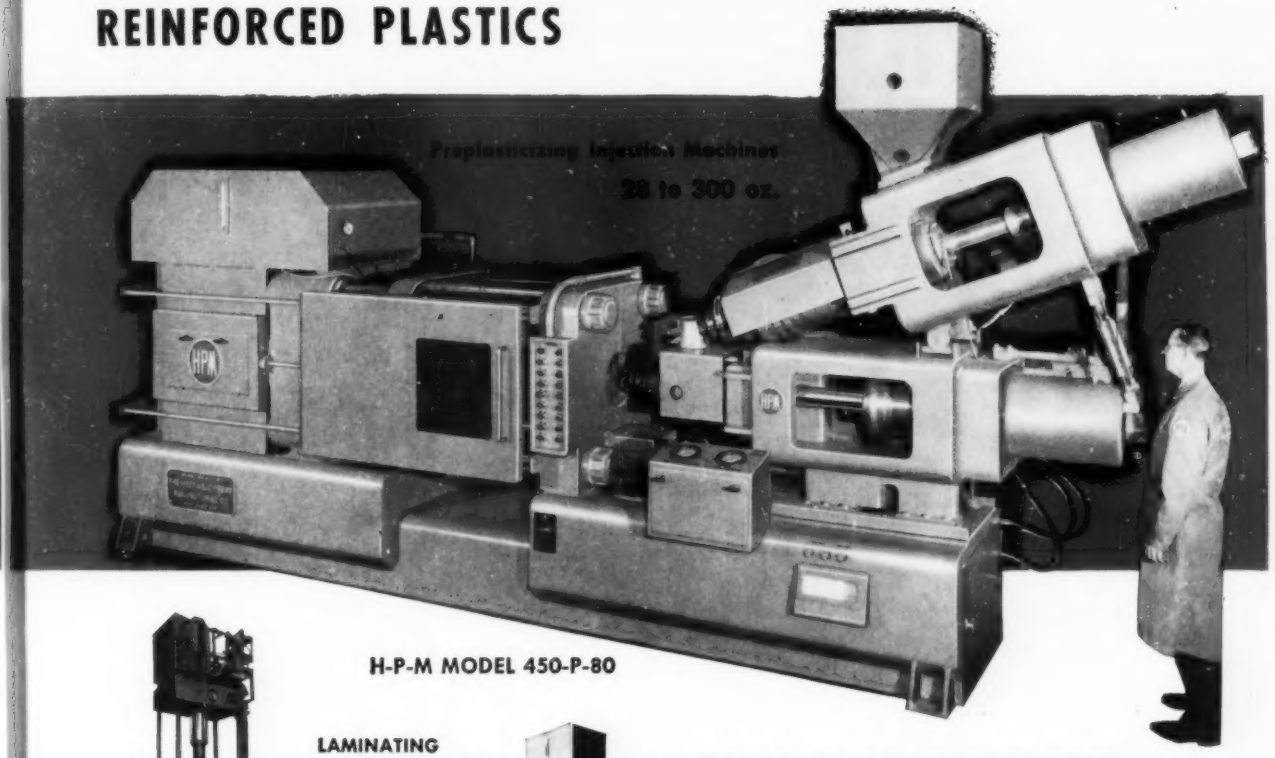
SPECIFICATIONS

Model	200 H 6/8	300 HV 12/16	450 HV 20/28	650 HV 32/42	800 HV 48/64	Long Stroke 800 HV 48/64	1500 H 80/100
Material Injected Per Cycle (oz.)	6-8	12-16	20-28	32-42	48-64	48-64	80-100
Material Injected (Cu.In.Per Min.)	675	1130	1450	2510	2800	2800	3320
Plasticizing Capacity (Lbs. Per Hr.)	80	135	200	300	300	300	400
Mold Clamp Capacity (Tons-Max.)	200	300	450	650	800	800	1500
Platen Size (In.)	26x26	30x33	36x42	48x48	55x55	55x55	72x72
Clearance Between Tie Rods (In.)	15½x15½	17x20½	21x27	30½x30½	36½x36½	36½x36½	48½x48½
Daylight Opening (Max.) Without Ram Spacer (In.)	25	30	40	50	55	84	106
Daylight Opening (Max.) With Ram Spacer (In.)	21	26	34	42	47	76	94
Mold Thickness (Min.) w/o Ram Spacer (In.)	10	10	15	20	20	30	46
Mold Space (Min.) With Ram Spacer (In.)	6	6	9	12	12	22	34
Clamp Travel (Max.)	15	20	25	30	35	54	60
Motor Horsepower	30	45	75	107½	127	127	150
Shipping Weight (lbs.)	16,500	27,000	41,000	76,000	87,000	98,000	215,000

NOTE: All injection capacities specified above are for general purpose polystyrene

EVERY MOLDING JOB

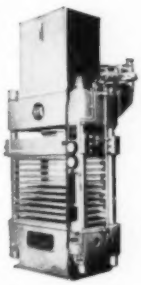
REINFORCED PLASTICS



H-P-M MODEL 450-P-80

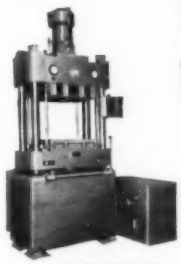
LAMINATING

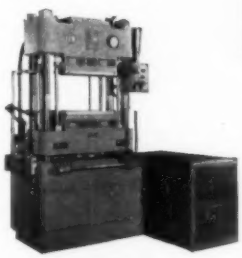
Multiple hot plate presses with steam or electrically heated plates for compressing or curing laminated material. Built to customer's requirements.



REINFORCED

A complete line of stock presses from 50 to 200 tons, designed specifically for molding reinforced plastics. Larger sizes built to order. Write for Bulletin No. 54041





TRANSFER

Stock sizes 100, 200, 300 and 500 tons. Larger sizes up to 2500 tons built on special order. Write for Bulletin No. 57021

COMPRESSION

Stock sizes 100, 200, 300 and 500 tons. Larger sizes up to 2500 tons built on special order. Write for Bulletin No. 57021

PREPLASTICIZING INJECTION MACHINES

EXTREMELY FAST . . .
EXCEPTIONALLY HIGH INJECTION RATE . . .
EACH SHOT EXACT IN WEIGHT

A completely new design concept in preplasticizing makes possible the production of minimum weight parts with absolute control over shot weight. This is accomplished by the combined operation of a new type three-way, rotary material control valve and an adjustable stop nut. They are ideal for filling deep, thin-walled sections or large areas that must be filled rapidly. Parts are better in quality and uniform in size and weight.

SPECIFICATIONS

Machine Model	200-P 28	450-P 80	650-P 140	800-P 200	1500-P 300
Material Injected Per Cycle (Oz./Max.)	28	80	140	200	300
Clamp Tonnage	200	450	650	800	1500
Plasticizing Capacity (Lbs. Per Hr.)	80	200	300	300	400
Mold Space (Max.) (In.)	15x26	20½x42	30x48	36x55	48x72
Daylight (In.)	25	40	50	84	106
Mold Thickness (Min. Without Spacer) (In.)	10	15	20	30	46
Stroke (In.)	15	25	30	54	60
Rate of Injection (Cu. In./Min.)	1350	1530	2510	5300	6640
Horsepower	50	75	107½	227	275

Note: Machines can be equipped for higher speed injection if desired

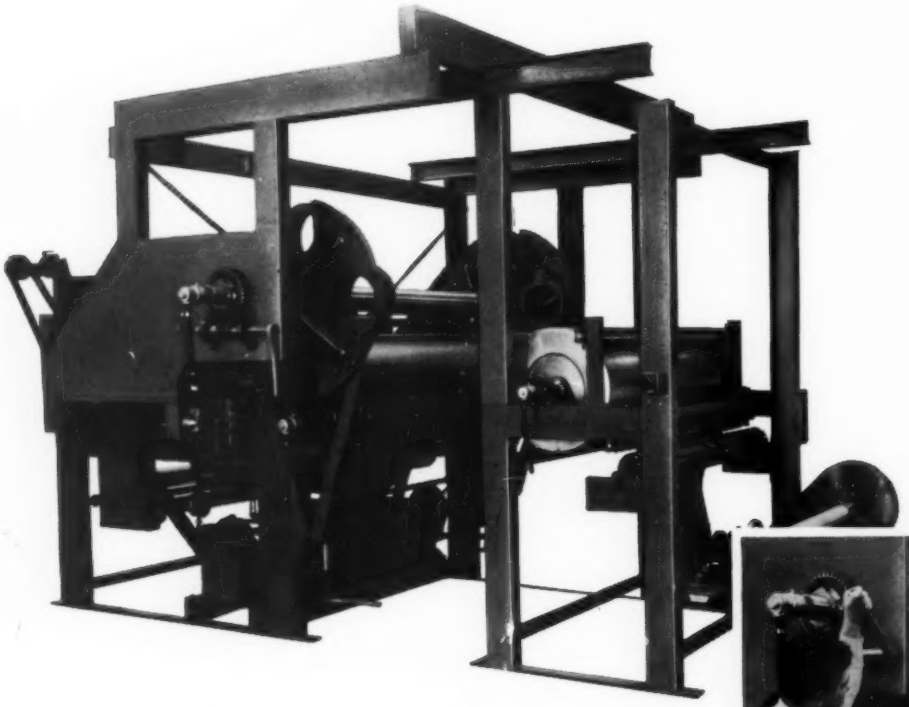
HPM

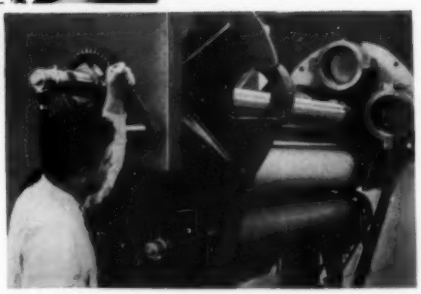
H836

THE HYDRAULIC PRESS MFG. COMPANY

A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U. S. A.

New Lembo
TURRET EMBOSSER





Leave it to Lembo to come up with this handy, practical development on their Embosser. The necessity for frequent shut downs and roll changing in embossing heads is just about eliminated, thanks to the 2-, 3- or 4-roll turret.

Rolls can be changed in a minute or two; either manually or with optional motor drive. Just index to use any of the patterns on whatever plastic film you happen to be running.

Extra! New slat expander, now standard equipment on all Lembo Embossers. Maintains constant width on 60 or 80" face. Also available with new Variable Tension Controller.

Call now! We'll be happy to let you see the new Lembo Turret Embosser in operation.

There is only one Lembo Machine! Be cautious of "Lembo-Type" imitat'ons.

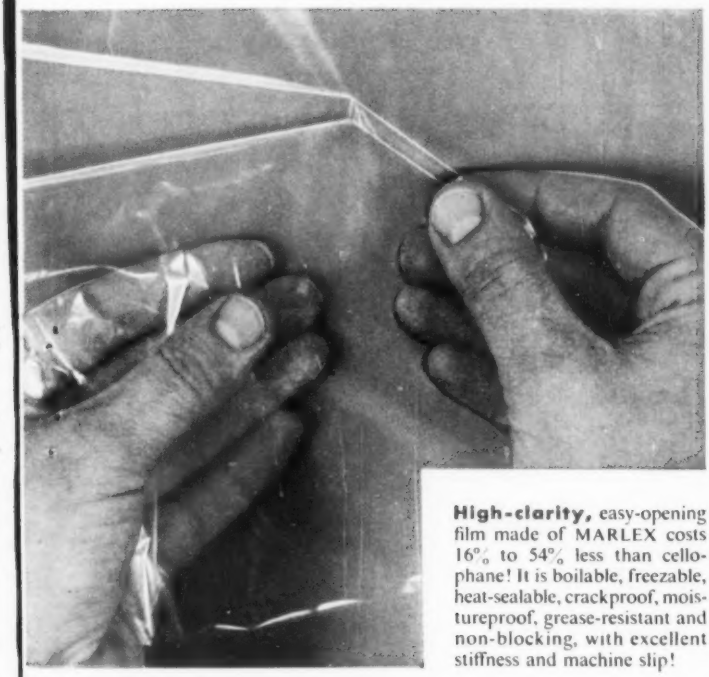
LEMBO MACHINE WORKS, INC.

248 East 17th Street • Paterson 4, New Jersey • LAmbert 5-5555
Mfrs. PRESSES • EMBOSSERS • LAMINATORS • ROLLERS

ROTOGRAVURE LEMBO PRESS LAMINATION

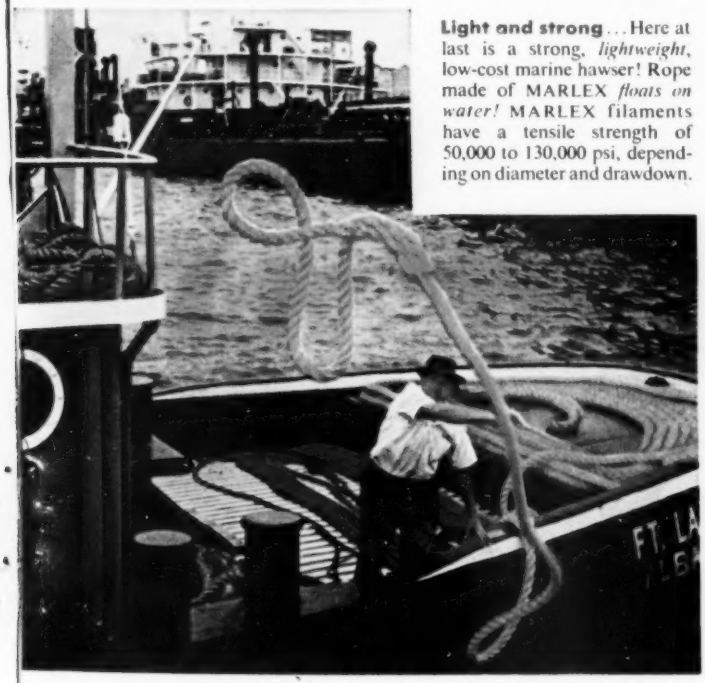
Cable Address:
Lemco, Paterson, N. J.

How can MARLEX* serve you?



High-clarity, easy-opening film made of MARLEX costs 16% to 54% less than cellophane! It is boilable, freezable, heat-sealable, crackproof, moistureproof, grease-resistant and non-blocking, with excellent stiffness and machine slip!

Durable and corrosion-proof . . . These attractive, new post lanterns made of MARLEX are really durable . . . won't rust and never need painting! They stand up well in any weather, even in damp salt air or smog!



Light and strong . . . Here at last is a strong, *lightweight*, low-cost marine hawser! Rope made of MARLEX *floats on water!* MARLEX filaments have a tensile strength of 50,000 to 130,000 psi, depending on diameter and drawdown.

Tough and rigid . . . Lightweight MARLEX tote boxes and trays have what it takes for rugged service in restaurants and institutions. They don't splinter, dent or stain . . . and they withstand repeated freezing and steam cleaning.

*MARLEX is a trademark for Phillips family of olefin polymers.

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma
A subsidiary of Phillips Petroleum Company

PLASTICS SALES OFFICES

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322 Waterman Avenue, East Providence 14, R. I. GEneva 4-7600	80 Broadway, Suite 4300 New York 5, N. Y. Digby 4-3480	318 Water Street, Akron 8, Ohio FRanklin 6-4126	111 S. York Street, Elmhurst, Ill. TErrace 4-6600	317 N. Lake Ave., Pasadena, Calif. RYan 1-0557	6010 Sherry Lane Dallas, Texas EMerson 8-1358

MARLEX

"Always lookin' for trouble..."

You've seen him on TV. Lean. Mean. Tough. Always lookin' for trouble.

Well, he has his counterparts at Boonton, sort of. We call 'em employees.

Of course, these fellows may not look like television stars. But then they don't have to. Just so they keep lookin' for trouble . . . like detecting streaks or tears or rippling in the surfaces of molded materials . . . or defects hidden way inside the pieces.

We've been "riding close herd" on our customers' jobs for 37 years now. Maybe that's the reason we've been entrusted with work by so many of the nation's best-known "brands".

But how about you, pardner? Turning a complete job over to Boonton is the best way we know "to keep peace on the reservation".

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

New York Metropolitan Area—Cortlandt 7-0003
Western New York Area—Alden 7134
Connecticut Area—Woodbine 1-2109 (Tuckahoe, N. Y.)
Philadelphia Area—Pioneer 3-0315

polyvinylchloride

Emulsion and suspension polymers for general purposes.
Special grades for dielectri uses, unplasticized extrusion and calendering.
Paste-making PVC resins (plastisols).
General purpose copolymers.
Special grades for LP records, vinyl asbestos floor-tiles, rigid opaque, tinted or clear sheeting, for vacuum forming.
Special copolymers designed for solution applications.

Solvic is supplying PVC and copolymers in large quantities to plastic users throughout the world. In addition, Solvic manufactures PVC compounds and colour concentrates (masterbatches) under the trade name, BENVIC.

Write for additional technical information.

SOLVIC S. A. 244, RUE DE LA LOI - BRUSSELS (BELGIUM)

Affiliate companies and works in Austria, Brazil, France, Germany, Italy and Spain.

WHEREVER ANYTHING STICKS
YOU'LL FIND A USE FOR . . . . .

IMS SILICONE SPRAY
Mold Release

Molders who have tried them all always come back to genuine IMS Silicone Fluid Spray. They like its consistent quality, balanced formula, and a package approved by their production-conscious operators.

Look for free bonus card

PRICES

Single cans	$ 2.00
Unbroken dozens	$ 18.00
Unbroken gross lots	$197.40

(Same day shipment — Delivery free)

IMS ZINC STEARATE
Dry Powder Spray

Puts dry dust right where it is needed without waste. Avoids excessive use of zinc stearate, which causes costly wear of mold pins and machine parts. The only successful Dry Powder Spray!

PRICES

Single cans	$ 2.00
Unbroken dozens	$ 13.80
Unbroken gross lots	$144.00

(Same day shipment — FOB Cleveland)

IMS PAINTABLE SILICONE
All Metal Value

IMS exclusive formula S-1001 permits painting, stamping and plating of molded parts. Contains special Silicone which does not interfere with painting, printing or plating operations. Not as effective a mold release as IMS Silicone Spray, so specify S-1001 only when necessary.

Single cans	$ 2.00
Unbroken dozens	$ 18.00
Unbroken gross lots	$197.40

(Same day shipment — Delivery free)

IMS NEUTRAL OIL SPRAY
for polyethylene

Giant Size Can

This economical inert spray comes in a king-size can. An excellent release agent for polyethylene — reduces tendency towards environmental stress cracking and crazing caused by silicone type lubricants on injection molded articles and on certain film and sheet materials.

Single cans	$ 2.00
Unbroken dozens	$ 18.00
Unbroken gross lots	$197.40

(Same day shipment — Delivery free)

EXCLUSIVE TWO STEP ANTI-RUST PROCESS

Step 1 — Blue Can

NEUTRALIZER

Removes fingermarks, neutralizes acid perspiration stains, picks up condensed moisture, and cleans off ordinary oils. For best results wipe off neutralizer before applying rust preventative.

PRICES

Single can	$ 2.00
Per Set of 2	$ 3.00
Per Unbroken Dozen	$18.00

(6 of Step 1; 6 of Step 2)

Step 2 — Orange Can

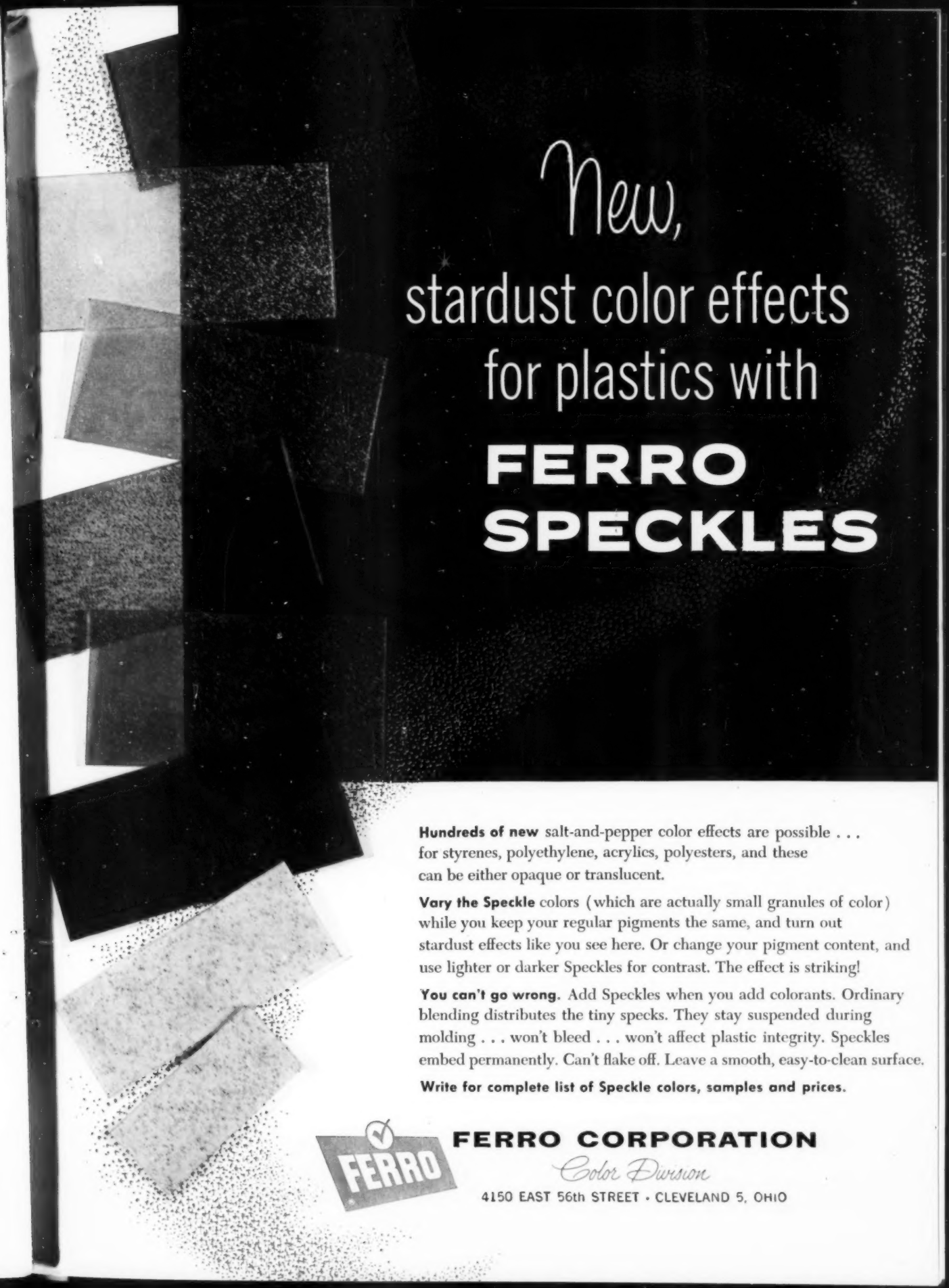
RUST PREVENTIVE

Protects against moisture. Stops rust on all mold surfaces, tools, dies, etc. Use on all machine surfaces when molding vinyl. Clean, permanent protection. Wipes off with or without solvents.

(Same day shipment — Delivery free)

Send For Complete Sample Kit - All 6 IMS AEROSOLS For only $9.00

IMS INJECTION MOLDERS SUPPLY COMPANY
3514 LEE ROAD · WYoming 1-1424 · CLEVELAND 20, OHIO



Hundreds of new salt-and-pepper color effects are possible . . . for styrenes, polyethylene, acrylics, polyesters, and these can be either opaque or translucent.

Vary the Speckle colors (which are actually small granules of color) while you keep your regular pigments the same, and turn out stardust effects like you see here. Or change your pigment content, and use lighter or darker Speckles for contrast. The effect is striking!

You can't go wrong. Add Speckles when you add colorants. Ordinary blending distributes the tiny specks. They stay suspended during molding . . . won't bleed . . . won't affect plastic integrity. Speckles embed permanently. Can't flake off. Leave a smooth, easy-to-clean surface.

Write for complete list of Speckle colors, samples and prices.

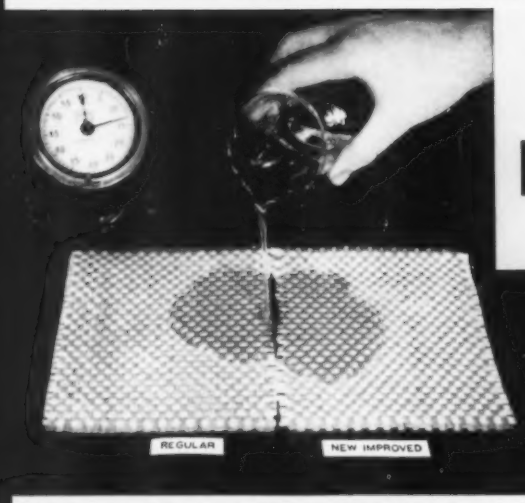
FERRO

FERRO CORPORATION

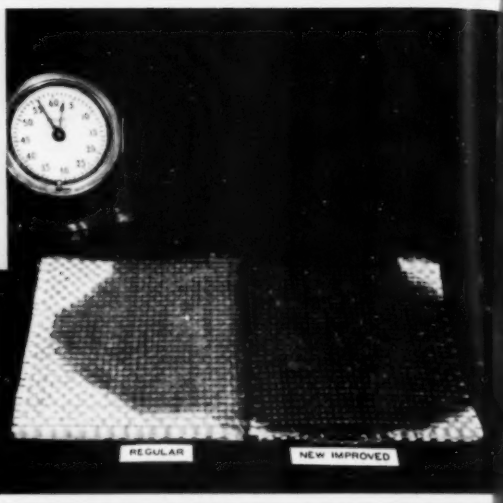
Color Division

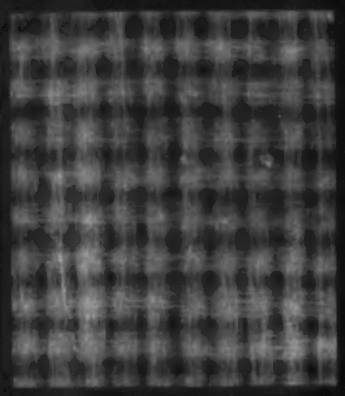
4150 EAST 56th STREET · CLEVELAND 5, OHIO

TRY IT! See the Difference!

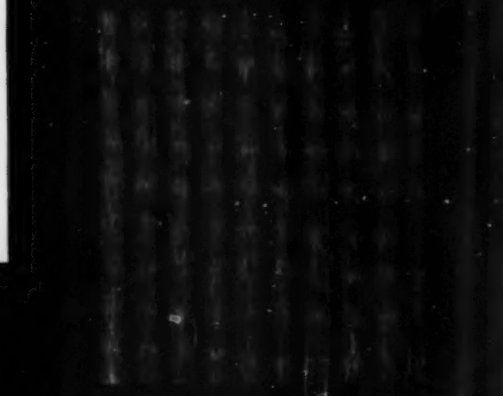


In your Production!





In your Finished Product!



New improved UNIROVE cuts costs, helps quality

Attention, open-mold fabricators! Ferro's new sizing for woven roving can speed production, cut costs, improve the quality of your products. You get much *faster,* more *complete wet-out,* increase the productivity of your workers, reduce the "show through" pattern of fiber glass reinforcement.

You'll find Ferro's UNIROVE® consistently uniform in weave, sizing and strength. Every roll is checked against high-quality standards at every stage of production. This gives you extra value at low woven roving costs. Why not try UNIROVE in *your* production.

FERRO

FERRO CORPORATION

FIBER GLASS DIVISION

Nashville 11, Tennessee.... Huntington Beach, California

another word for

PLENCO

To assure molded products that are cool to the touch . . . gleam with good looks . . . resist wear as well as rust as well as shock as well as acids and grease . . . the exceptional value of *phenolic* molding compounds to the appliance industry has long been demonstrated.

Designers and molders have learned to handle the problem with ease and economy. To handle with confidence in the uniquely ideal properties of phenolics . . . bred to withstand the rigors of life in kitchen and laundry room. To handle, in more and more instances, with *Plenco.*

Appliances, of course, cover a lot of territory. But so do Plenco resins and the services of Plenco engineers. In the variety, versatility and quality-controlled excellence of Plenco phenolic molding materials, industry men in all fields find the answer to their most demanding requirements.

You should find it well worth while to consult with our technical staff.

PLENCO PHENOLICS
FOR BETTER
PLASTIC PRODUCTS

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and compounds

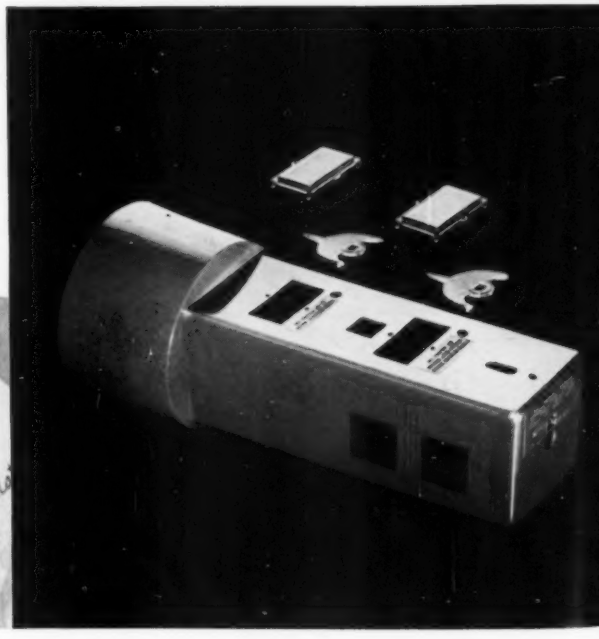
PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

Nashville 11, Tennessee.... Huntington Beach, California

Dow plastics excel as basic design materials

COLORFUL STYRON® 475 provides a smart appearance and it bypasses corrosion problems completely in this new room cooler. The housing and three trays are vacuum formed of this versatile Dow plastic. This compact unit has high impact strength yet it's light enough to be carried by a child. The outstanding formability of sheet extruded from Styron 475 makes for ease and economy of production. The circulating tube is extruded from a formulation of Dow PVC resins.

TOUGH ETHOCEL® supplies all the qualities required of this unique headlight aimer housing. The super-high impact strength of Ethocel, under a wide range of temperature conditions, is ideal for rough-and-tumble treatment in garages and outside in cold weather. Dimensional stability provides excellent fit for parts as well as accuracy for the instrument itself. A glossy, easy to clean surface makes the housing attractive as well as practical—an important consideration in today's style-conscious market.



Seven different materials, dozens of formulations in the big family of Dow plastics offer many combinations of useful properties and a wide selection of colors. Keep Dow plastics in mind as a basic design material for your next project. For information about new developments in plastics, contact the Dow man near you. Or, write THE DOW CHEMICAL COMPANY, *Midland, Michigan, Plastics Sales Department 1516B.*

YOU CAN DEPEND ON DOW

these thermatic Series* extruder

features mean higher production on every job!

Simplified one piece cylinder with integrally cast-in Xalloy liner.

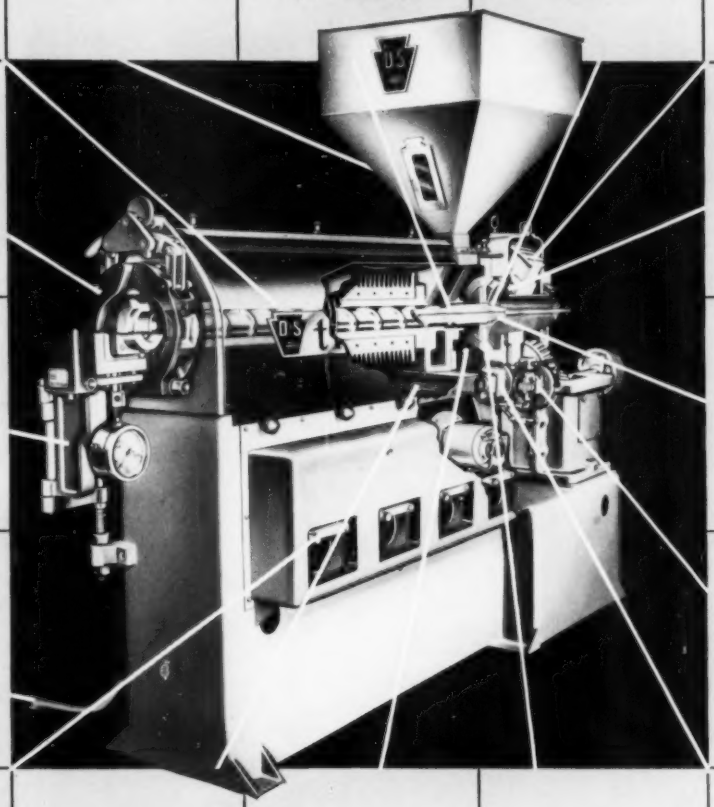
Extra large capacity stainless steel hoppers.

Screw flight extends back beyond the feed throat opening for improved powder and granule feeding.

Four-spline screw drive eliminates the eccentric screw rotation of a single key drive.

Helical gearing — smooth, efficient, free-running. Greatly increased horse-power capacity.

New stronger head clamp. Simplified opening and closing of head with positive safety shear pin arrangement.



Higher thrust bearing capacity. Extra-heavy separate thrust and radial bearings handle their respective loads individually to meet constantly increasing production requirements.

Improved hinged head support swings completely clear of the front of the extruder.

Tapered drive end of stock screw positively centers screw and simplifies removal.

Heaters and controllers completely wired for fast inexpensive installation.

Gear type oil pump, positively driven from input shaft, lubricates all bearings and gears regardless of speed.

Damper arrangement provides several gradients of natural draft cooling. Blowers provide high circulation for stubborn cooling jobs.

Air-tight oven effect adjustment by new second set of dampers for high temperature extrusion.

Access opening allows easy replacement of bronze feed throat bushing.

Labyrinth oil seals — simple non-wearing design. No oil seals or rings to replace.

Built-in direct drive stock screw electric tachometer.

Greater cylinder lengths standard on all extruder sizes with optional L/D ratios available. **2½", 3½", 4½", 6" and 8" models available.** The New D-S thermatic Series Extruders will outproduce — size for size — any other extruder on the market today. For complete specifications and details write to:

DAVIS - STANDARD
Division of FRANKLIN RESEARCH CORPORATION
16 WATER STREET, MYSTIC, CONNECTICUT

*Patented

IN CANADA CONTACT E. V. LARSON CO. LTD., 572 QUEEN STREET EAST, TORONTO 2, ONTARIO
IN EUROPE AND THE STERLING AREA CONTACT FAWCETT, PRESTON & CO. LTD., BROMBOROUGH, ENGLAND

ALSTEELE *Granulators and Pelletizers*

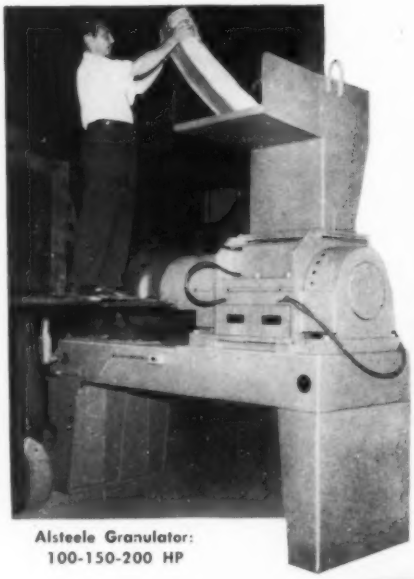
are all the name implies—and more!

Alsteele Granulators

ALSTEELE GRANULATORS handle the entire range of thermoplastics, whether the material be .001″ film or 11″-thick chunk solids. Even the largest molded objects require no prior sawing. And ALSTEELE GRANULATORS cut polyethylene and vinyl so the bulk factor will approximate your virgin material.

For extra durability, the Granulator cutting chambers are *all steel* . . . for extra strength, the hardened forged rotor is machined from *all steel* . . . and for smooth, constant cutting the two large heavy duty flywheels are *all steel*. Heavy duty machines are *water cooled*.

To meet your every need in plastics reducing machinery—whether for beside-the-press operation or for heavy duty chunk grinders — ALSTEELE GRANULATORS come in 26 models ranging in size from 3 HP to 200 HP, with cutting chambers up to 5′.



Alsteele Granulator: 100-150-200 HP

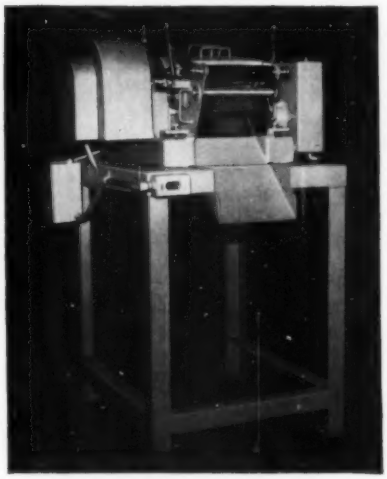
Beside-the-Press Granulators in a complete range of sizes

WATCH FOR IT!
The ALSTEELE Exhibit at Booth 312 NATIONAL PLASTICS EXPOSITION in Chicago. Nov. 17-21.

Alsteele Pelletizers

The Alsteele line of pelletizers works with extruders 2½″ to 6″ or larger. Instant synchronization with an extruder is made possible by the U. S. Varidrive. And ease of operation, maintenance and cleaning is insured by extremely compact design.

Additional features are excellent uniformity of pellets, and clean cutting action—even on elastomerics. A greatly lowered noise level is still another benefit.



Hi-Speed Pelletizers to handle entire extruder output

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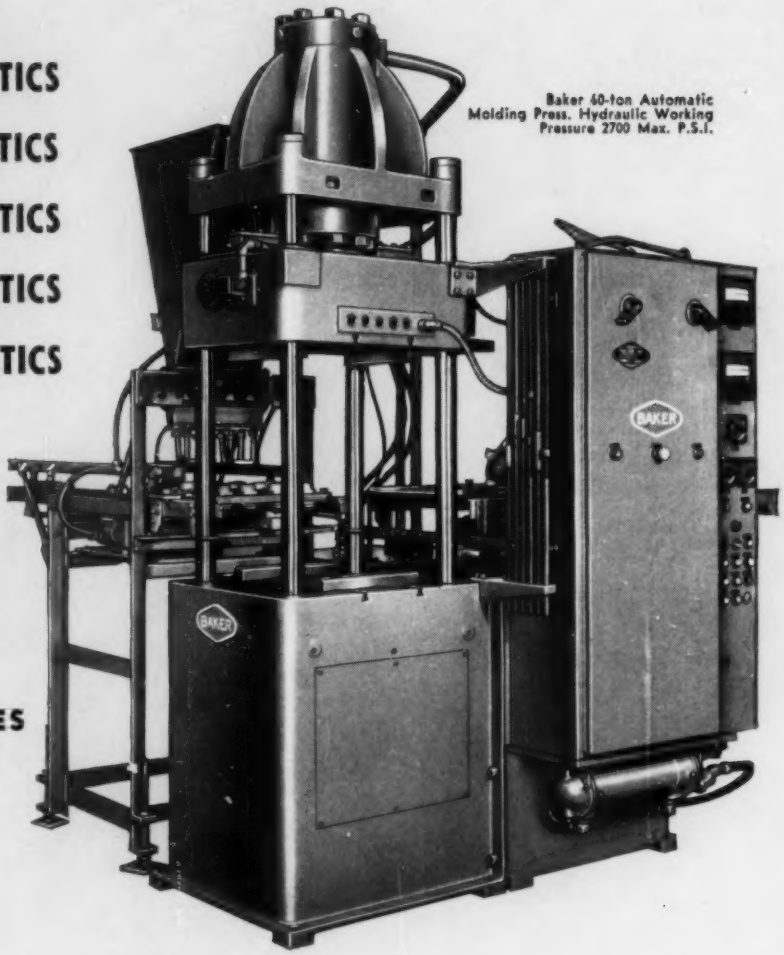

Baker 60-ton Automatic Molding Press. Hydraulic Working Pressure 2700 Max. P.S.I.

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NATIONAL PLASTICS EXPOSITION
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In 60, 75, 100, 150, and 175-ton Automatics — Baker led in sales because these machines have what it takes to produce lower piece part prices. Independent upper and lower hydraulic ejection, an automatic safety reflex that stops press if a part fails to eject, time and length of all functions instantly adjustable — these are the reasons more companies are purchasing Bakers. For the full story, write Baker Brothers, Inc., 1002 Post Street, Toledo 10, Ohio.

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Celluloid in sheets, tubes and rods.

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PVC (Polyvinylchloride) in calendered and pressed sheets, tubes, rods and profiles. Compounds for injection molding and extrusion.

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Cellulose Acetate in sheets, tubes and rods.

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Nitrocellulose for lacquers and technical uses. Bleached linters.

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Manufacturers of plastics for over thirty years.
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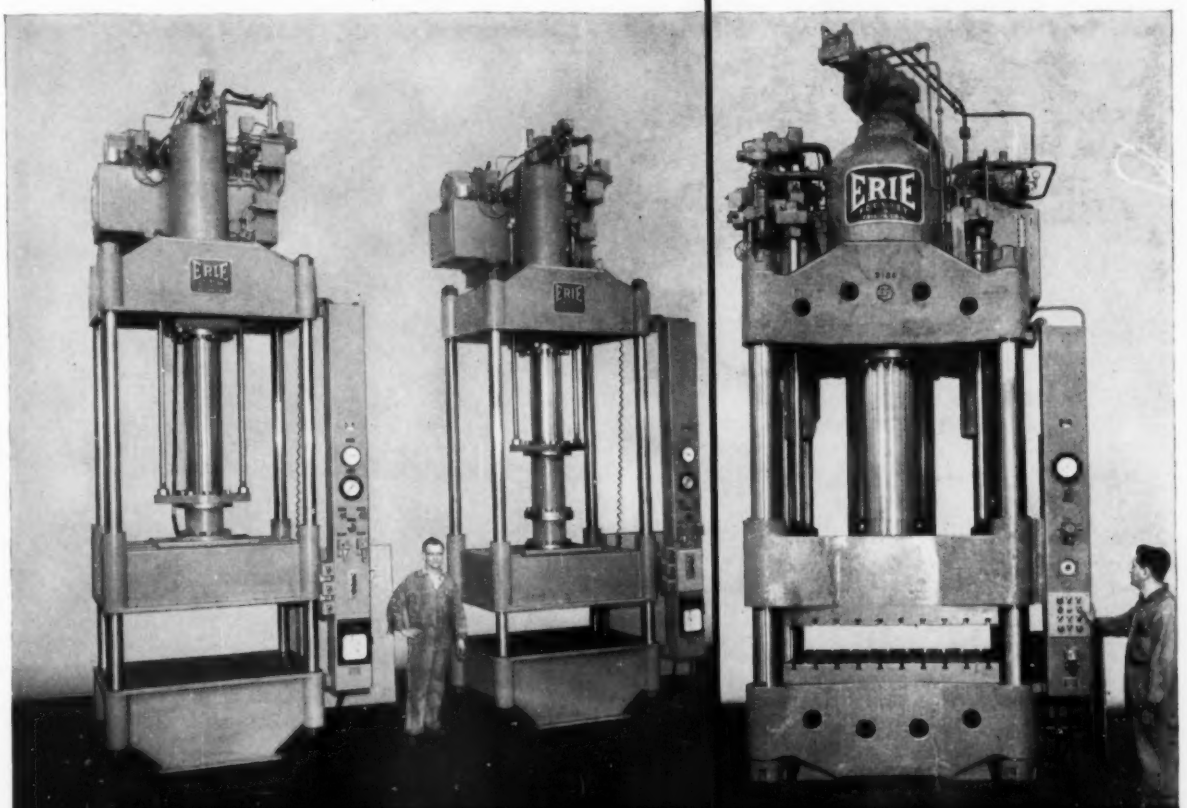
These two 150-ton fiberglass molding presses offer 48" stroke... 54-ton pull back. When desired, the opening can be reduced by ram spacers which, in this case, are 12" and 24". The Oil Gear drive offers molders a very accurate pressing speed adjustment ... the ultimate possible. Controls are semi-automatic; plates are 56" x 42". Your maintenance men will welcome the minimum piping and valving on these self-contained presses.

This very rugged fiberglass press is rated 750 tons with a 48" stroke. The two pull backs give 150-ton stripping capacity. Oil Gear drive with quick-acting prefill system allows molders to utilize five ram speeds in their molding cycle. Automatic short stroking of pump at required pressures for long periods of time assures both reduced h.p. consumption and oil heating. Controls are semi-automatic, and the 2 steam-heated platens are 60" x 46".



THERE'S AN ERIE PRESS for EVERY FIBERGLASS MOLDING JOB

Whatever your molding needs, plastic, fiberglass or rubber, why not consult Erie Foundry before you plan? We can be of great help.

For more information, please write:

ERIE FOUNDRY CO.
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ERIE SINCE 1895

Even pouring rain can't harm these heavy-duty polyethylene shipping bags, pioneered by Spencer Chemical Co. Here hygroscopic ammonium nitrate is being stacked in open field during recent rainy season. Also, two years of tests show 25 to 50% less bag breakage with polyethylene compared to kraft paper.

Read why Spencer Chemical Company has decided to use

Heavy Duty Polyethylene Bags To Ship Thousands of Tons of Fertilizer:

Two years of tests show bags give complete moisture protection, cut bag breakage to 0.77% or less . . .

Many large-scale industrial shippers will be interested in Spencer Chemical Company's decision to trust their own products to a new heavy duty polyethylene shipping bag. For this decision is the best possible proof of Spencer's own faith in that bag, pioneered by Spencer over a two-year period.

This fall Spencer will start shipping thousands of tons of "Mr. N" Ammonium Nitrate in 10-mil polyethylene bags. It was an important decision, made only after a series of grueling tests.

In over 2½ million lbs. of shipments of "Mr. N," only 0.77% of 51,240 bags were broken. In a test involving shipments of polyethylene resin, breakage was only 0.72% — less than half of kraft paper's 1.5%.

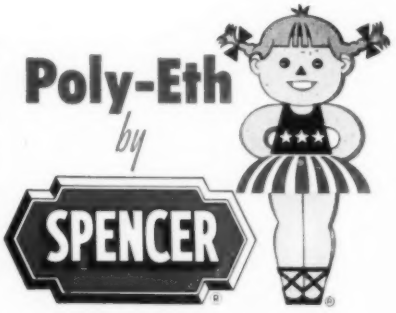
Material loss is slight, even when bags are broken. For instance, one dealer reported the loss from eight broken bags in a car of fertilizer was less than one quart. Further, broken bags can be easily repaired with pressure-sensitive tape.

Completely moisture-proof, these bags can be stacked in an open field, even in pouring rain. This feature is of major importance, not only to "Mr. N," but to nearly all hygroscopic products. It means, too, that feeds and food products can be stored for months with practically no moisture loss.

These bags are easy to heat-seal. Fifty pound bags of ammonium nitrate can be filled and sealed at the rate of 16-20 bags per minute per machine -- a speed comparable to rate for 50 pound paper bags. All bags are corrosion-proof, non-toxic, and contamination-proof.

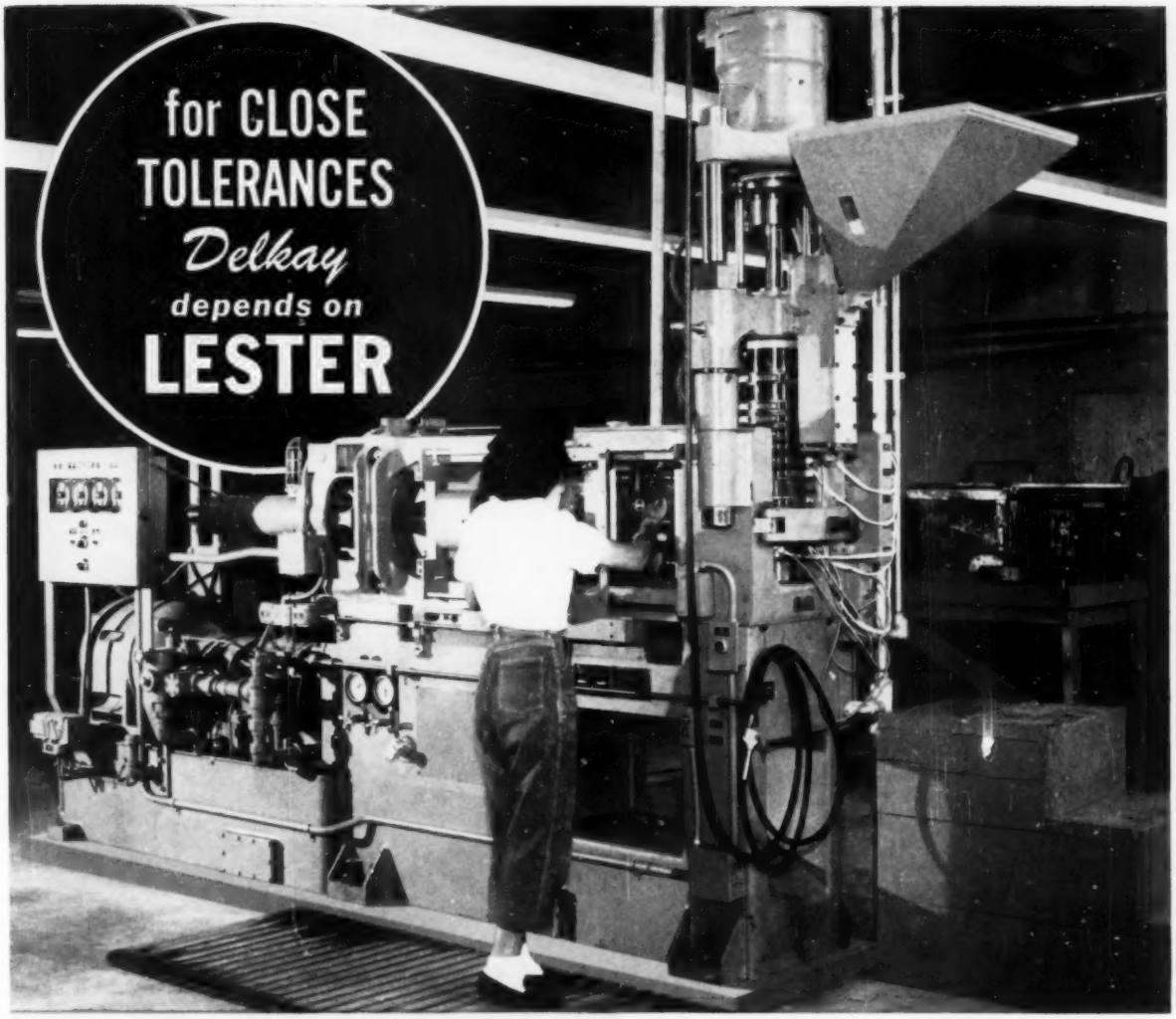
If you're an extruder, find out more about Spencer "Poly-Eth" Polyethylene, the super-tough resin used in pioneering these new bags. If you're a packager, ask where you can get these extra-protective bags for your own product. See a Spencer salesman or write to Market Development Section, Spencer Chemical Co., Dwight Bldg., Kansas City 5, Mo.

Packaging Institute's 20th Annual National Packaging Forum Oct. 13, 14, 15, 1958 Edgewater Beach Hotel Chicago, Ill.



SPENCER CHEMICAL COMPANY

Dwight Building . . . Kansas City 5, Missouri



Delkay Plastics Corp. of Gardena, Cal. says:

"The nylon parts shown are molded for Cannon Electric Company, the world's largest manufacturer of multi-contact electrical connectors, with a reputation for highest quality and reliability. The reliability is extremely important. It might mean the difference between a Vanguard in the air or on the ground. Therefore, here at Delkay, we must adhere to extremely close tolerances in both thin walled and heavy walled sections and in multiple cored parts.

"Our new 4-Ounce Lester machine enables us to meet these specifications while eliminating drool and the resulting 'strings' and also through the elimination of freezing at the nozzle. The result is a savings of both time and materials. The Lester performance is beyond our expectations."

LESTER-PHOENIX, INC.

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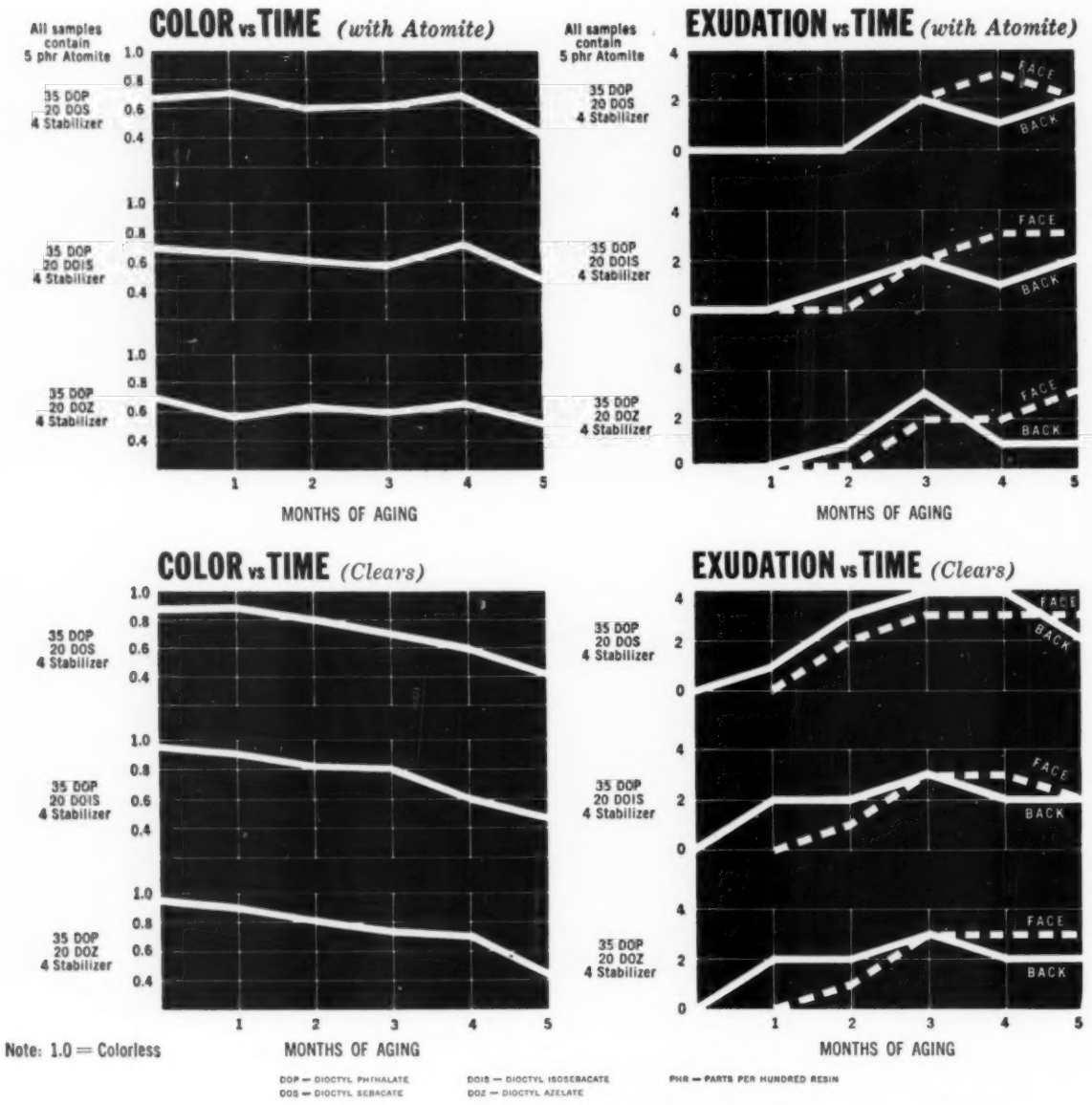

Florida aging tests show ester of **ISOSEBACIC® ACID** matches performance of other vinyl plasticizers ...and it is more economical

The dioctyl ester of ISOSEBACIC® acid matches the performance of more costly dioctyl sebacate and azelate as a plasticizer for vinyl resins. The evidence is provided by the above charts of a recent, independently conducted test.*

ISOSEBACIC acid is a new synthetic intermediate made by U.S.I. A mixture of three C-10 dibasic acids —2-ethyl suberic, 2, 5-diethyl adipic, and sebacic acids— it offers a number of interesting properties. Other uses include—intermediate for polyamides, polyesters, polyurethanes and alkyd resins.

ISOSEBACIC acid soon will be available in commercial quantities from U.S.I. at Tuscola, Ill. Price comparisons with competitive intermediates indicate that ISOSEBACIC acid will afford important savings.

This might be a good time to evaluate ISOSEBACIC acid for your operations. Send for data sheets and samples.

*Test results supplied through the courtesy of Deecy Products Co., Cambridge, Mass.

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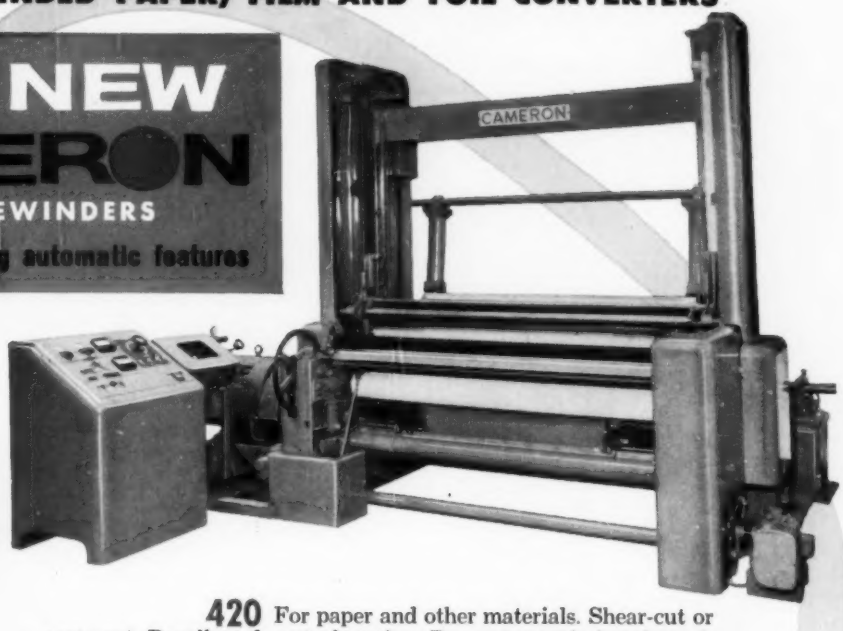
TWO NEW CAMERON SLITTER-REWINDERS

with new cost-cutting automatic features



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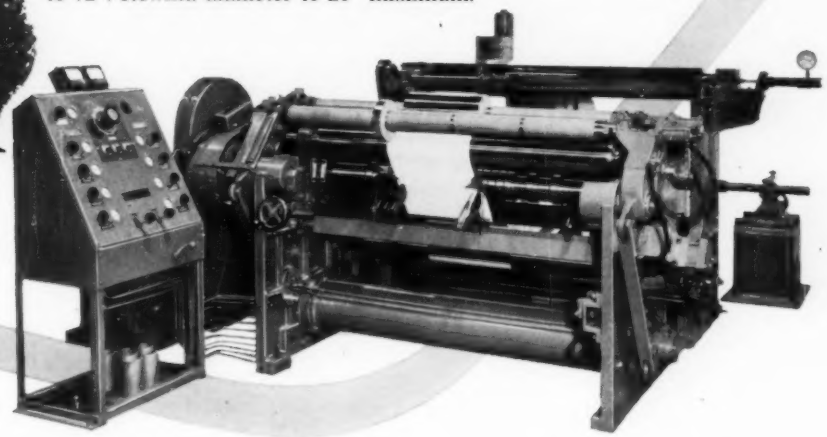
420 For paper and other materials. Shear-cut or score-cut. Panelboard control station. Power transmission through positive toothed belts. Electric riding roll lift available. Speeds to 3500 fpm*. Widths 42″ to 82″. Rewind diameter 42″ maximum.

620 SERIES

620 For off-caliper materials including paper, film, foil and laminates. Score-cut, shear-cut, or razor-cut slitting, singly or in combination. Speeds to 1000 fpm*. Trim widths 32″ to 72″. Rewind diameter to 20″ maximum.



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Just when you need them most, we are proud to announce two great new Cameron machines, designed by our team of specialists to put *you* way out front in roll production. They give you new labor-saving automatic and semi-automatic production features, and new, superior web controls to improve the quality and reduce the cost of your roll products. They provide new versatility for quick, easy set-ups, fitted to the exact requirements of the newest papers, films, foils and laminates.

A Cameron specialist will be happy to call at your plant to show how the 420 or the 620 can be custom-fitted to your needs. It will pay you to write, wire or telephone for an early appointment.

Cameron Machine Company, Franklin Road, Dover, N. J.

Canada: Cameron Machine Co. of Canada, Ltd., 15 Hatt St., Dundas, Ontario

France: Batignolles-Chatillon, 5 Rue De Monttessuy, Paris (7e) France

*Speed depends on width, number of cuts, and characteristics of material.

Built by Cameron's team of specialists

AA-355

50 years devoted exclusively to the design and manufacture of slitting and roll winding equipment.

SMD-3500

A free-flowing polystyrene compound offering both excellent moldability and fast set-up. Along with low bulk factor, this material provides good electrical, mechanical and optical properties. Widely used for injection molding operations.

TMDA-6000

A high-impact, rubber-modified polystyrene with low bulk factor, free flow and quick set-up. Izod impact strength is as much as 5 times that of general-purpose styrenes.

TMDA-9001

Good flow and fast set-up are combined in this medium-impact, rubber-modified polystyrene. Surface gloss and translucency are excellent. Widely used for caps, closures and containers.

RMD-4511

Possesses exceptional resistance to chemicals and high heat, as well as unusual flexural and tensile strength properties. These make this acrylonitrile-styrene copolymer ideal for surface hardness, dimensional stability and rigidity in service.

TMDB-5161

In addition to a high heat distortion point, this high-impact, rubber-modified polystyrene affords superior mechanical strength and good electrical properties. An outstanding material for radio cabinets and similar applications. Molds with good flow and release; set-up is fast; surface gloss is superior; colors are excellent.

TMDB-2155

A rubber-modified polystyrene with extra-high impact strength even at temperatures of −25° C. **Strongest rubber-modified styrene on the market today!** Molding properties are excellent; ease of flow at molding temperatures; fast cycles; good mold release; and a minimum of strains and weld lines.

Which styrene would you choose for this product?

"BAKELITE" PLASTICS
BRAND

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THE PRODUCT:
Domestic food waste disposer encased in a sound-deadening, molded plastic shell. Designed by Waste King Corporation, this "Super Hush" model is quieter—lighter, easier to install—combines attractive colors with durability. Molded by Industrial Molding Corp., Culver City, Calif. and Modern Plastic Co., Los Angeles, Calif.

THE PROBLEM:
Pick a plastic which affords ease of molding to the "sculptured" design desired. In addition, provide for chemical inertness, resistance to heat, and excellence of color and lustre. Above all, provide for durability in service with properties of high impact strength.

THE SOLUTION...
to this manufacturing problem is in the *wide selection* of BAKELITE Brand Polystyrenes. If you selected TMDB-5161 as your choice for this "Waste King" Pulverator you matched up properties to performance requirements *exactly* as countless of fabricators are doing every day with BAKELITE Brand Plastics.

For the right styrene to meet *your* needs exactly, discover the full range of BAKELITE Brand compounds. And, to assist you in your selection, call on the services of your Bakelite Company Technical Representative—or write Dept. IC-29G.

In addition to the styrene molding materials described at left, Bakelite Company provides for your selection these others:
SMD-3000 (unmodified heat-resistant Styrene)
SMD-3700 (high-flow Styrene for containers)
RMD-4500 (high-clarity Acrylonitrile-Styrene)

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You can save 3c per pound by buying pleogen 1700 and thinning with your own styrene to normal working viscosity.

Pleogen 1700 is a rigid, general purpose polyester resin used for all types of laminating and molding.

This extremely high viscosity resin is shipped at 45,000-75,000 centipoises.

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American Petrochemical Corporation
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The Plastiscope*

September 1958

News and interpretations of the news

By R. L. Van Boskirk

Section 1

Koppers broadens range for high-density polyethylene. High-density polyethylene resins (Super Dylan) with melt indices of 6 and 9 are now being marketed by Koppers Co. in what is claimed to be the first offer of formulations with a melt index (M.I.) of more than 5 by a low-pressure-process polyethylene producer. The new resins are suggested particularly for film and paper coating and may be used for flat die and water bath extrusion, chilled roll, or blown. They are reported to give a better hot draw down, greater clarity, faster output, and easier handling.

Other melt indices in Super Dylan resins furnished by Koppers are 0.2—suggested for wire coating, bottles, sheet, filament, pipe; 0.4 and 0.8—for extrusions where stress crack and strength is less critical; 1.5—for industrial molding where properties are of greater importance than ease of molding; 3.0—for general injection molding; 6.0—is also suggested for thin-wall molding and fast cycles.

The new resins are made possible by improved production techniques and the continuous-process method employed by Koppers at its recently completed 30 million-lb. plant in Port Reading, N. J.

More about foamed polystyrene cups. Crown Machine & Tool Co., Fort Worth, Texas, is now producing from 1 to 1½ million units per month of its "patent applied for" new polystyrene foamed cups under the tradename Thermokup. Production will be between 4 and 8 million units a month by the end of 1958. The cups are used extensively on airlines for coffee and are in demand by large companies for in-plant feeding. Total market for hot and cold drink cups is now thought to be over 1.4 billion a year and the Crown foamed cup is thought to be eligible for most of this market, except the estimated 200 million or so used in vending machines. The world market for all throw-away drinking cups is said to be 5 billion a year. If foamed polystyrene gets one half this market, it could account for 15 million lb. of raw material.

Aside from insulation value, cups are comparatively low in cost. A 7-oz. cup, with walls 100 mils or 1/10 in. thick, weighs only 3 grams. The same size cup in a thin-wall high-impact styrene material weighs 8½ grams. The foam has a density of 4 lb./cu. ft.—impact styrene about 65 lb./cu. ft.

The cup costs the user between $12 and $13 a 1000 compared with paper at from $9 to $12, but since airline companies generally use two cups for each serving of coffee to prevent discomfort to the fingers from transmitted heat, the foam cup is more economical.

The cups mentioned above are made by an entirely new and unique process, developed by Crown, said to be a combination of vacuum, extrusion, and injection molding. In this process polystyrene beads, developed especially

*Reg. U.S. Pat. Off.

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COLOR DISPERSIONS FOR POLYETHYLENE AND VINYL

Creativity...uniformity...quality—you'll find them at their peak in Master Color color concentrates...in a range of colors so imaginative and complete it puts a rainbow to shame. Creativity that produces any color you may desire. Uniformity that assures you of perfect dispersion and exact color control, run after run. Quality control that makes certain your products will have the truest colors of them all.

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The Plastiscope

(*Continued from page* 39)

for foaming, are continuously fed into a rather small machine containing especially designed low-cost molds.

Crown will manufacture the cups for sale in its adjacent territory and has granted a sole license to manufacture and sell them in other market areas to Champion Paper & Fibre Co., Hamilton, Ohio.

Polypropylene drinking cup. Crown has cups on the fire other than those made of foamed styrene. One is a 9-oz. drinking cup injection molded of polypropylene. Its wall section is only 16 mils thick—just a tiny bit thicker than the older 14-mil impact styrene cup. The polypropylene cup is now being used in hospitals because it can be sterilized and is almost indestructible. It sells for less than half the 11¢ glass tumbler which it is designed to replace. The only complaint so far raised is that it floats when placed in a dishwasher, but that is generally considered a trivial matter.

Polyethylene film for garment bags. High clarity, thin-gage polyethylene film, produced by a method which is said to be more efficient and to impart superior strength properties, is being made by the newly formed American Extrusion Corp., Hightstown, N. J. Production is done on Davis-Standard extruders. According to the firm, the process differs to some extent from the conventional blown tube method and gives almost no waste.

The company will initially concentrate its efforts on quality garment bag grade film in the 1/10- to 7/10-mil range. Prices are said to be well in line with the current market prices for conventionally produced materials.

New producers of caprolactam look for increasing nylon market. Ohio River Chemical Co., a joint enterprise of Industrial Rayon Corp., Painesville, Ohio, and Spencer Chemical Co., will construct a 20 million-lb., $10 million caprolactam plant near Ashland, Ky. Completion is expected in early 1960. John E. Straub, formerly production superintendent at Spencer's Vicksburg, Miss., plant, will be general manager.

Commercial Solvents Corp. has also announced that it will begin marketing caprolactam by December 1, 1958 from a company plant in Peoria, Ill.

Caprolactam is the material from which nylon-6 is produced; benzene and furfural are used by Du Pont to produce nylon-6/6. Most of ORC's caprolactam will probably be diverted to production of textiles for floor covering and other uses by Industrial Rayon and some will be sold in the open market, but Spencer expects to devote a sizable portion to production of nylon-6 molding material.

Estimators vary considerably in their judgment on consumption of nylon plastics for 1958, but Du Pont refuses to enter the guessing contest. Others, however, generally figure about as follows: molding material, 16 million lb.; wire coating and jacketing, between 2 and 3 million; extrusions, 1 million; and monofilaments somewhat under 5 million pounds. A conservative estimate projecting to 1963 is given by one source as molding material, 30 million lb.; extrusion, 13 million; and special processing such as rod, slab, plate, and casting, 2 or 3 million pounds. Any five-year guess on nylon is considered

Portable warehouses 4 stories high...

An all-weather "Airhouse" of U. S. Rubber Fiberthin vinyl-coated nylon is manufactured by Irving Air Chute Co., Inc., Lexington, Ky. Thermatron generators and presses are used to weld the seams of the structure which is supported entirely by air pressure. At left an "Airhouse" is shown before inflating.

supported by air and THERMATRON electronic welding

No rigid wood or metal framework supports these unique houses – just a thin shell of vinyl-coated nylon and low pressure air. Part of the secret of Irving Air Chute's seemingly impossible "Airhouse" is the airtight, watertight seams permanently welded on Thermatron high frequency presses and generators.

Thermatron welding gives added strength to plastics—seams are actually stronger than the material itself! What's more, it's fast and economical, particularly important in such large scale applications as the "Airhouse," hatch and aircraft hanger protective covers and swimming pool liners.

High frequency plastic welding isn't limited to giant items—Thermatron is a vital cost-cutting, product-improving factor in the fabrication of toys, upholstery, clothing, luggage, automotive assemblies and many other plastic products. In fact, if you fabricate vinyl plastic in any way, Thermatron can point the way to faster and better production methods.

We'll be glad to make tests on your own material and offer suggestions without obligation. Write today to Section MP-9

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The Plastiscope

(*Continued from page* 41)

hazardous because a possible lower price and the future effect of competition from Delrin, polyolefins, and polycarbonates are not known.

Included in the above estimate is 2 or 3 million lb. for extruded chilled roll film which may be used for packaging meat and greasy products and for vacuum packed tea and coffee. The present price of extrusion grade is $1.28/lb. with a yield of 24,000 sq. in./lb. of 1-mil film. However, Spencer seems most optimistic of greatest growth in the extrusion of shapes, wire, and tubing, and in large moldings where spokesmen assert it has advantages in processability.

Polycarbonate resin developments. A new semi-works plant for Lexan polycarbonate resin is now in operation at the Chemical Development Dept., General Electric Co., Pittsfield, Mass. Designed to produce increased quantities of the new resin for market development work, the new plant will also provide prototype information for commercial plant design, as well as permit continuation of development of process and product technology.

Pilot plant batches of several hundred pounds of Lexan have already been shipped to various molders. G-E reports that parts molded from polycarbonate resin have been evaluated in more than 100 different applications, including items for the electrical, communications, and electronics industries, and parts for aircraft, automobiles, business machines, appliances, gages, and numerous other industrial applications.

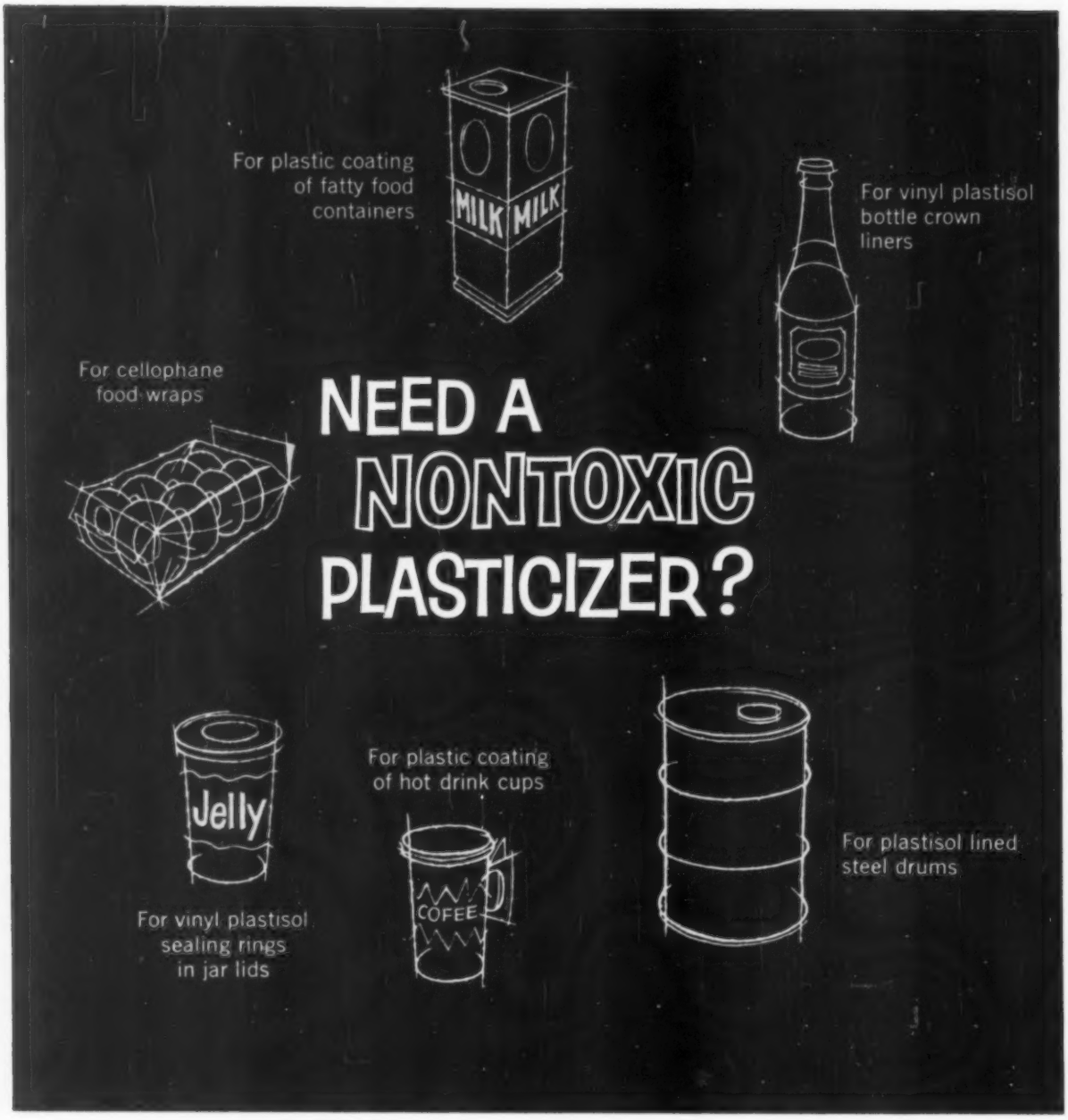
Polycarbonate resin is described as having some thermosetting properties in a thermoplastic product. The material is hard but so tough that strips of it can be bent double many times without breaking. Its high impact strength was demonstrated when an injection molded safety helmet did not break after repeated impacts of 68 ft.-lb. in a falling ball test.

The heat distortion point of the new resin is close to 290° F. either at a normal load of 66 p.s.i. or a heavy load of 264 p.s.i. Polycarbonate molding compounds are also characterized by excellent dimensional stability, superior heat resistance, and good electrical properties. (For a detailed discussion of properties, processing, and applications, see MODERN PLASTICS, April 1958, p. 131.)

Polycarbonates are also now under study by Mobay Chemical Co., Pittsburgh, Pa., which is jointly owned by Monsanto Chemical Co. and Farbenfabriken Bayer. Since Bayer is producing polycarbonates in Germany, it is natural for Mobay to think of the resin as a possibility for diversification of its own product line.

Vacuum forming machine plant sold. National Tool Co., Cleveland, Ohio, has purchased Auto-Vac Co., Bridgeport, Conn., for an unannounced sum. E. Bowman Stratton, Jr., president of Auto-Vac, has become a vice president of National Tool in charge of the Auto-Vac Division. Auto-Vac sales are reported to have averaged approximately $500,000 annually in the past few years. It was the first company to produce automatic machines for vacuum forming plastics sheets and grew out of Mr. Stratton's development of pre-printed colored plastics relief maps for the United States Government. The 53-year-old National Tool Co. is a producer of high-precision, gear-cutting tools.

Mr. Stratton stated that industry estimates indicate that 2 million


For plastic coating of fatty food containers
MILK MILK
For vinyl plastisol bottle crown liners
For cellophane food wraps
NEED A NONTOXIC PLASTICIZER?
Jelly
For vinyl plastisol sealing rings in jar lids
For plastic coating of hot drink cups
COFEE
For plastisol lined steel drums

The low cost of Pfizer CITROFLEXES® will surprise you!

For all these and many other plasticizer applications you should investigate the nontoxic, odorless Pfizer Citroflexes.

Citroflex A-2 (Acetyl Triethyl Citrate) for cellulosics is especially suited for use in plastic food wraps such as cellulose acetate packages for processed meats, doughnuts, etc.

Citroflex A-4 (Acetyl Tributyl Citrate) for polyvinyls is used in such vinyl products as food container coatings, bottle crown liners and for food-jar-cap sealing rings.

Both Citroflex A-2 and A-4 are nontoxic and odorless. They are accepted by the Food & Drug Administration for use in plastic packaging of both fatty and non-fatty foods.

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The Plastiscope

(*Continued from page* 43)

lb. of sheet were vacuum formed in 1952, 60 million in 1957, and that 200 million lb. will be formed in 1960. He predicts that Auto-Vac will get five to ten times its present business merely from growth of the art. Today there are only 1500 vacuum forming machines in contrast to 17,000 injection machines, but the former should eventually exceed the latter in number, he believes.

ASTM recommends polyethylene nomenclature. A tentative specification 1248-58T was officially adopted by ASTM on June 27, 1958, which suggests that polyethylene extrusion and molding materials be designated as follows: Type I, 0.0910 to 0.0925 density range; Type II, 0.0926 to 0.0940; Type III, 0.0941 to 0.965. It is suggested that they be called lower, medium, and higher density.

Teflon in automobiles. Du Pont lists the following Teflon applications for automobiles: bearings for clutch levers; diaphragm for transmission switches; valve seats in thermostats; carburetor throttle valve bearings; gaskets on lock nuts for power steering; piston rings for power steering; U-shaped and L-shaped shaft seals for power steering; and thrust bearings on speed controllers.

Furthermore, Du Pont claims 140 applications of its plastics materials in passenger cars. Zytel nylon accounts for 70 of them, of which the first was in a Ford speedometer nine years ago.

Nylon for wigs. A New York producer of the fancy colored wigs now frequently seen in high-style New York society gatherings, is using a combination of colored nylon (Tynex) and saran monofilaments. The new wig doesn't cost nearly as much as the $150 article made from human hair. The most popular colors are blue and pink and there are nine different "blonde" shades. Tynex wigs are said to hold their shape better than human hair.

Incidentally, 1958 is the 20th Anniversary of the first nylon application—tooth brush bristles. Newest development in that line today is colored bristles. And Tynex paint brush bristles are now being sorted by a Univac so that any desired variety may be incorporated in each brush. In one case, the machine helped produce an experimental brush which could make a continuous cut or edge for 14 in. without redipping where conventional brushes could produce only 4 to 5 inches.

New process for expanded polystyrene. Plasti-Foam Corp., 77 River St., Hoboken, N. J., has developed a process for producing self-extinguishing foam insulation from polystyrene beads that is claimed to be 30% lighter in weight than other polystyrene foams and to have a lower K factor than other foam insulations.

James J. Sullivan, president of Plasti-Foam, says that molding is done directly from the raw material without coating the beads. He asserts that an internal material that does not affect the product is used to obtain the self-extinguishing properties rather than antimony and chlorowax. Called Lo-K foam, it is suggested for use in a variety of commercial, industrial, and residential applications.

For additional and more detailed news see Section 2, starting on p. 214

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A Low Molecular Weight Polymer for:
injection molding of rigid products, especially pipe fittings . . . rigid extrusion of sheet and calendering

Uses for IRVINIL 630

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RIVER ROAD, BOUND BROOK, N. J.

July 30, 1957

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Attention: Mr. H. C. Felsher,
Chief Chemist

Dear Sirs:

The Surfacing and Printing Group of the Bakelite Company is very much interested in learning what inks Claremont would recommend for the flexographic and gravure printing of two of its recently developed products.

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PROCESSING OF "MOPLEN" *(No. 2 in a series)*

INJECTION MOLDING The high fluidity of "MOPLEN" permits molding of thin walled and complex shaped items.

Temperatures — Cylinder temperature should be maintained between 200°C and 250°C (392-482°F), depending on the form and weight of the molded piece, and should never exceed 270°C (518°F). Temperature at the nozzle should be about 30°C (54°F) less than that in the cylinder.

Pressure—Pressure should not be lower than 1200 kg/cm² (17,000 psi). Higher pressures (21,000 to 28,000 lbs/in²) are preferred.

Cycle times — May be very short, as in the case of polyethylene, using high injection speed.

Mold temperature — It is particularly recommended that the mold be run at not less than 50°C (122°F). The mold must be carefully chromium plated in order to obtain very smooth and brilliant surfaces.

Linear Shrinkage — Linear shrinkage varies from 1-2%. Normal rules should be followed when establishing mold sizes.

Coloring — All colors and shades can be obtained with "MOPLEN."

Protection against oxidation — Like polyethylene, the addition of carbon black with uniform dispersion, or similar opacifying agents, will impart permanent resistance to sunlight. "MOPLEN" is not affected by diffuse light.

For more detailed information about MOPLEN please write, outlining area of interest, to

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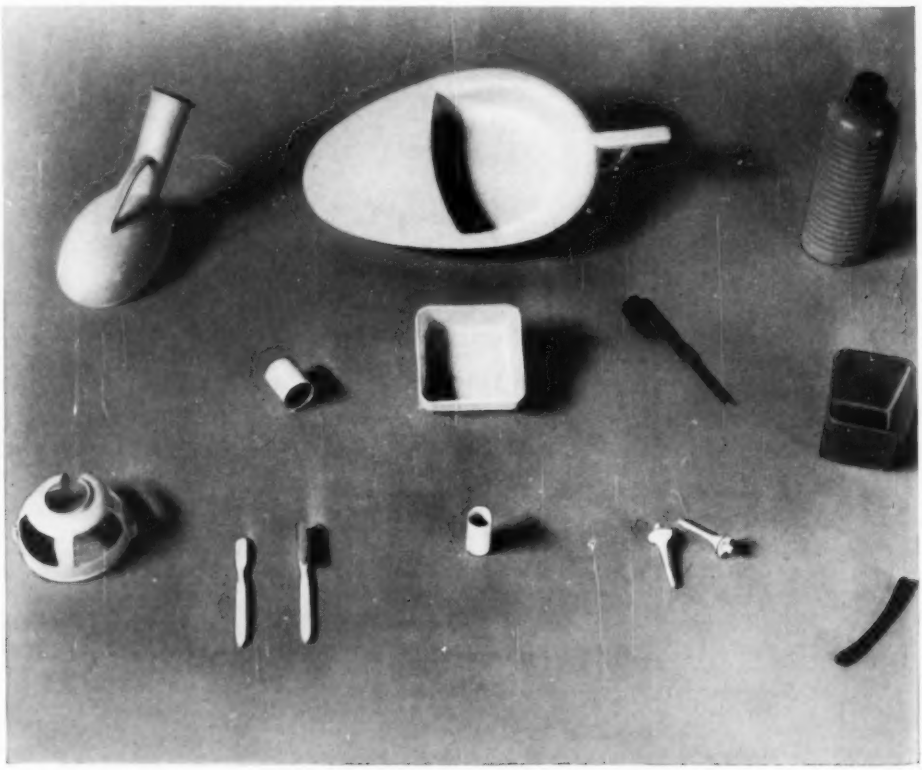
Sanitary products made from "MOPLEN" isotactic polypropylenes have excellent resistance to acids, alkalis, and various solvents. They are easily cleaned and sterilized. Economically produced in any desired color, with a high finish and excellent detail, they are light and warm to the touch.



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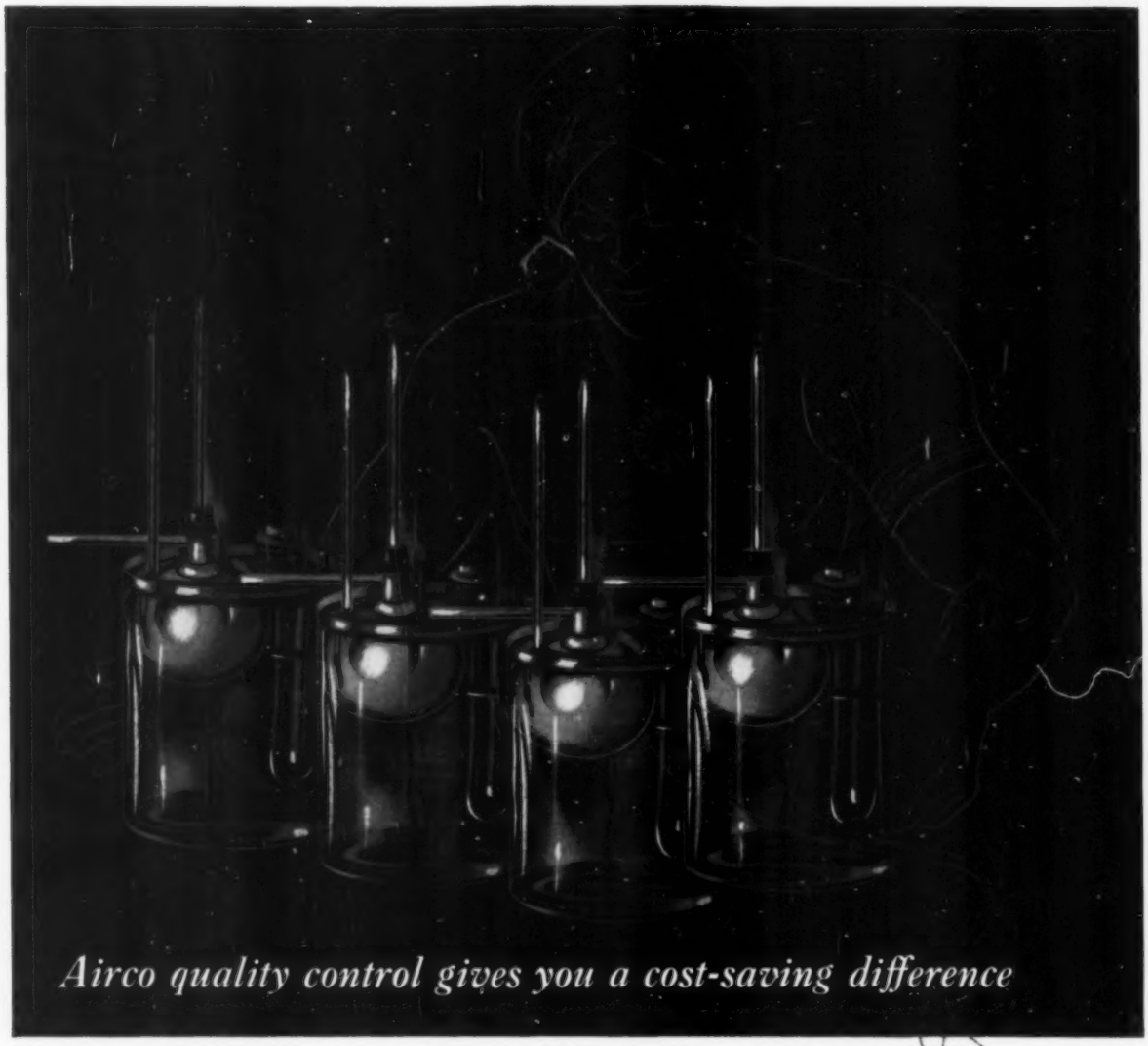

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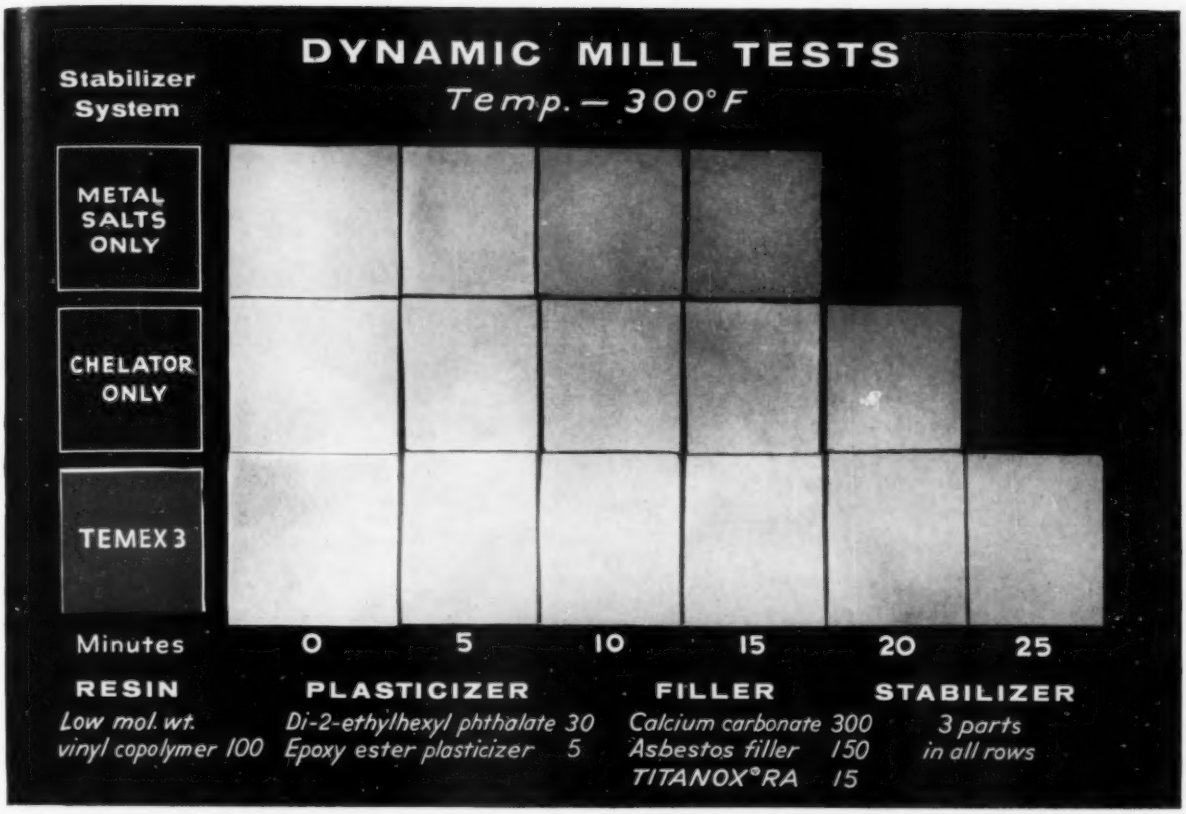

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What a difference in color retention between the three asbestos-filled flooring stocks pictured above!

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Broadens the list of usable tints. The low reactivity of Temex 3 stabilizer does away with pinking, bluing and other undesirable color shifts. You are free to use both lighter and stronger tints.

Prevents color degradation from reworked trim. As the test above shows, even extended heat histories do not darken Temex 3 stocks.

Double action lengthens color life, too

Once flooring is laid, "Dutch Boy" Temex 3 stabilizer continues to preserve beauty of flooring. It protects against attack of ultraviolet light. Stabilizer staining by sulfides is eliminated. Its protective action continues through long-term washing and wear.

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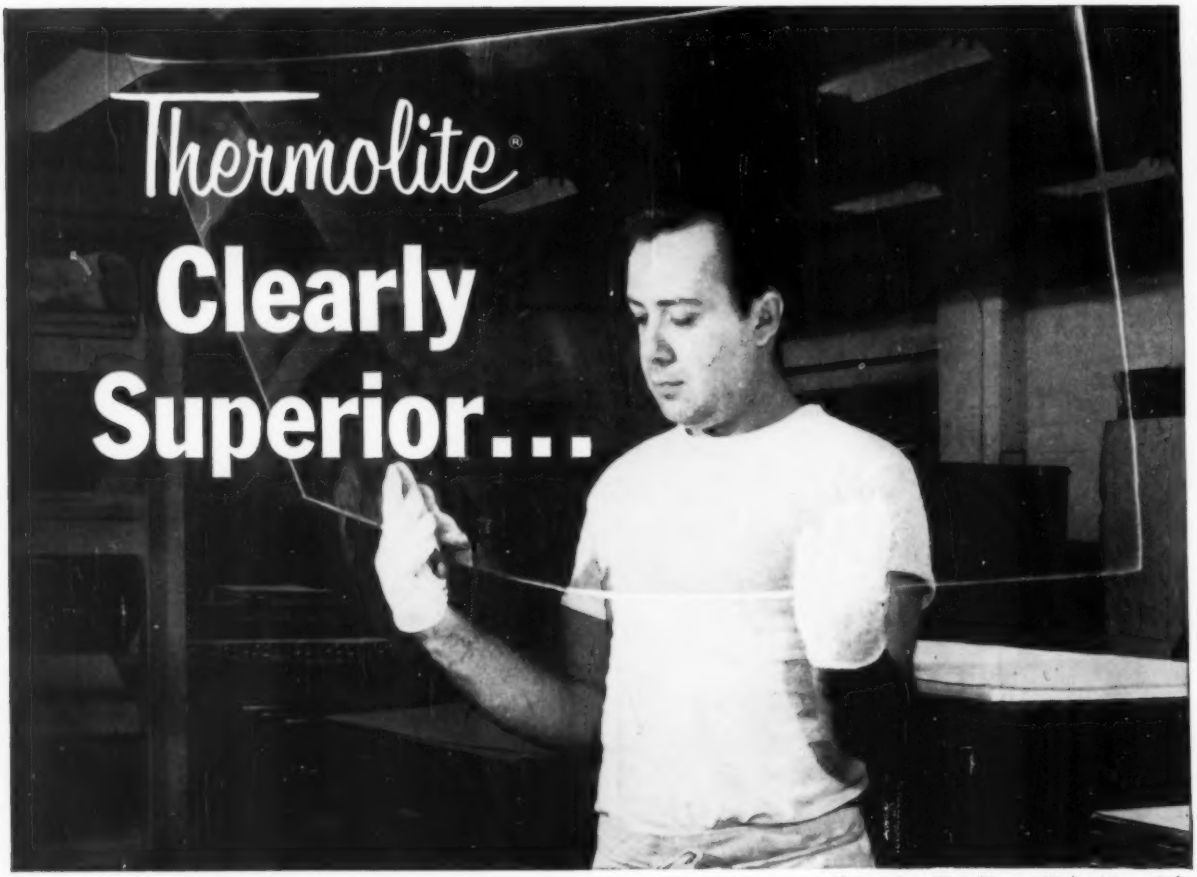

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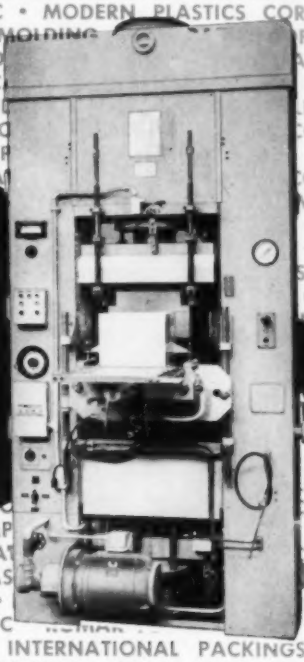

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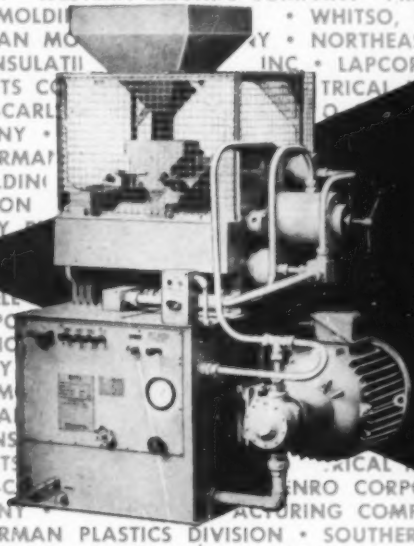

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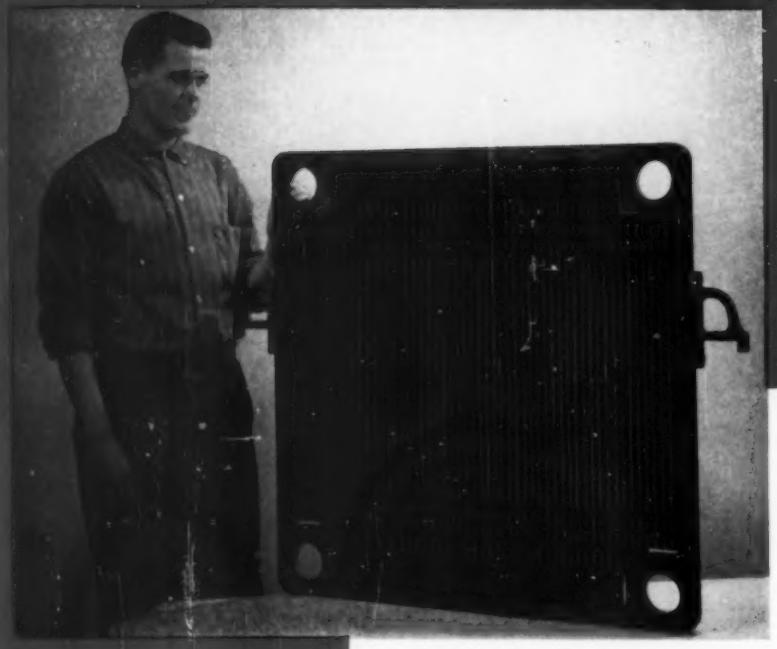

...with ATLAC Thermaflow reinforced polyester molding compounds

This 36" plate for a chemical filter would weigh 260 pounds if made from stainless steel or resin coated cast iron. Instead, it weighs *only 75 pounds* . . . costs only one-third as much as stainless steel . . . yet withstands high pressures and exposure to acids and alkalis.

This new performance is being obtained by making the plates of ATLAC THERMAFLOW 100, a reinforced polyester molding compound. The plates go into filters made by T. Shriver & Co., Inc.

A principal reason for the excellent chemical resistance of this material is that it contains ATLAC 382, a different kind of polyester developed by Atlas, which has superior ability to resist attack by many chemicals. Other ATLAC THERMAFLOW compounds are excellent for structural and electrical designs, because of their high impact strength, arc resistance, high heat distortion temperature and flame resistance.

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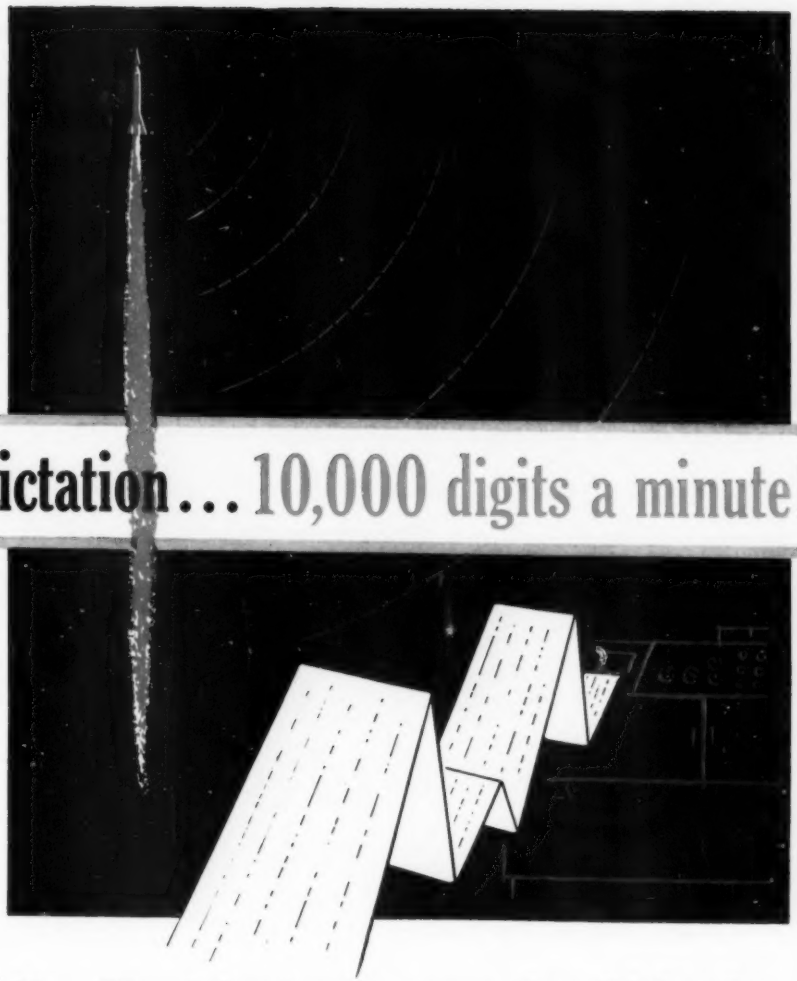

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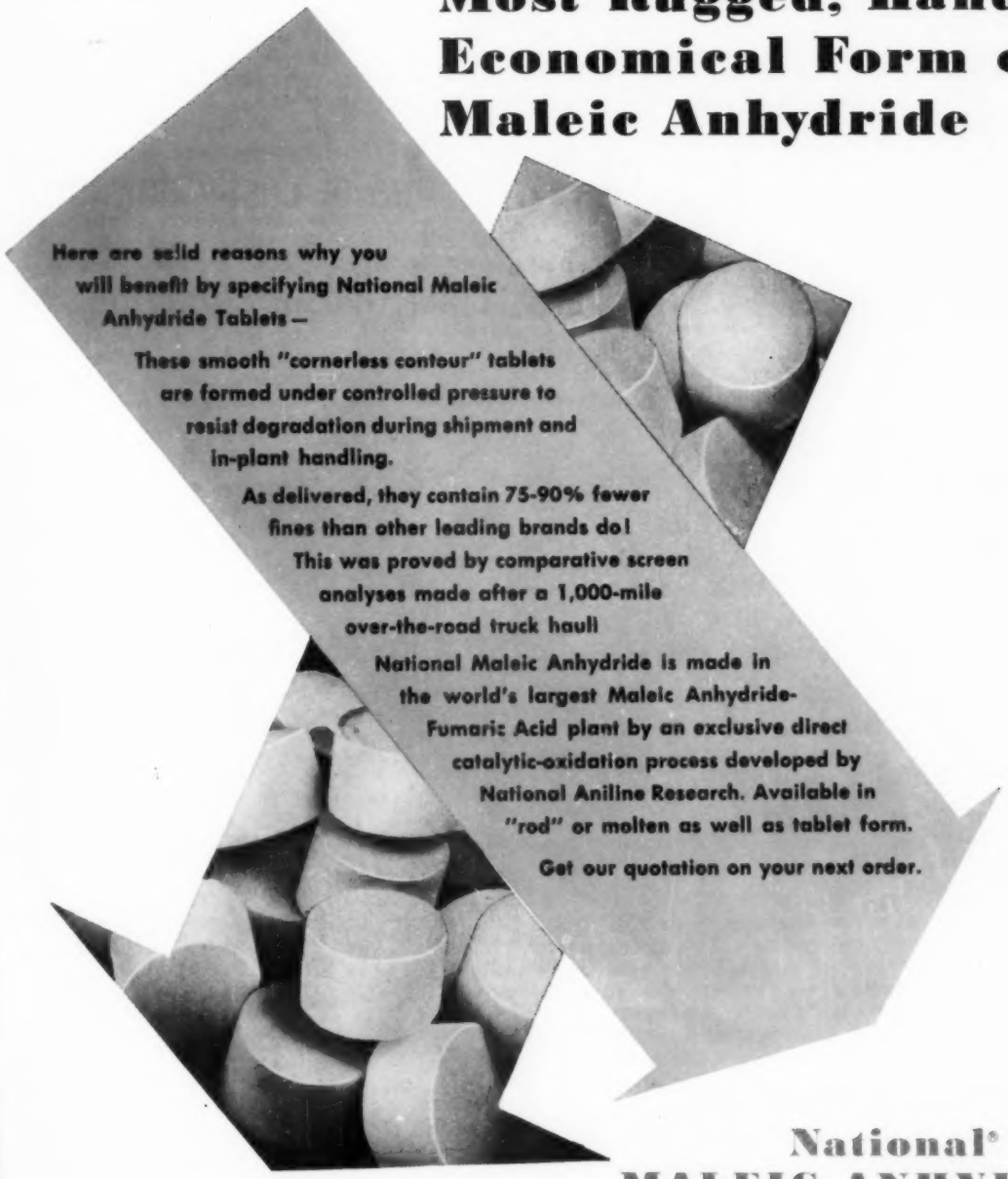
and still the

Most Rugged, Handy, Economical Form of Maleic Anhydride



Here are solid reasons why you will benefit by specifying National Maleic Anhydride Tablets—

These smooth "cornerless contour" tablets are formed under controlled pressure to resist degradation during shipment and in-plant handling.

As delivered, they contain 75-90% fewer fines than other leading brands do! This was proved by comparative screen analyses made after a 1,000-mile over-the-road truck haul!

National Maleic Anhydride is made in the world's largest Maleic Anhydride-Fumaric Acid plant by an exclusive direct catalytic-oxidation process developed by National Aniline Research. Available in "rod" or molten as well as tablet form.

Get our quotation on your next order.

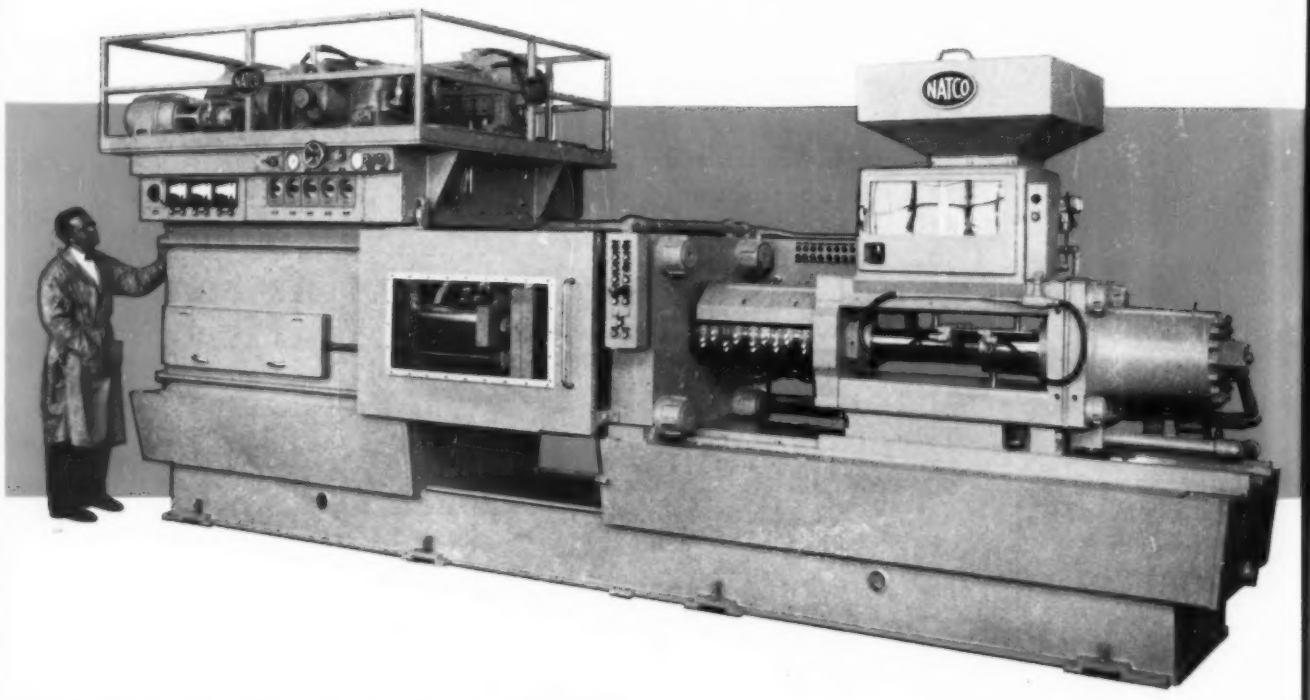
National®
MALEIC ANHYDRIDE
Tablets

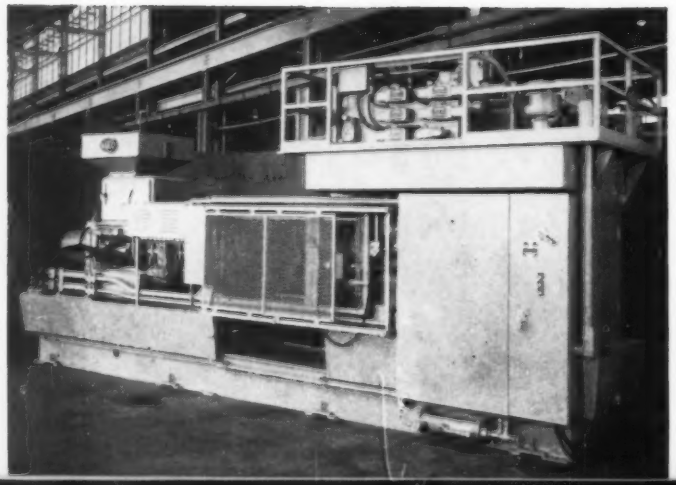
Allied Chemical

NATIONAL ANILINE DIVISION
40 RECTOR STREET, NEW YORK 6, N. Y.
Akron Atlanta Boston Charlotte Chattanooga Chicago Greensboro Los Angeles
New Orleans Philadelphia Portland, Ore. Providence San Francisco Toronto

These NATCO features give you:

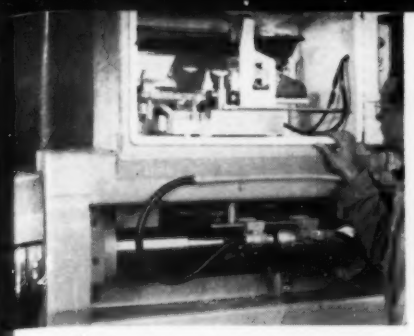
faster molding cycles: more parts per shift:
trouble-free operation: free of costly downtime:
higher quality parts: color, finish, strength:





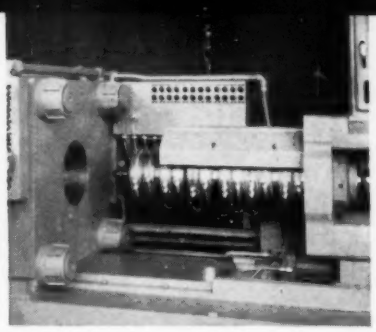
Integral electric controls save up to $1000 installation cost

The back of a Natco is just as clean and uncluttered as the front. All working elements are completely accessible. Because very little water is needed to cool the oil, heat exchanger is small. The rear guard is self storing. And there is nothing in the base but air — no pumps, motors or valves where you can't get at them. Because the Natco is completely shockless, all electric control equipment can be mounted directly on the machine and wired complete at the factory. All you do is to bring three power lead lines to the machine — no separate cabinets with expensive wiring.



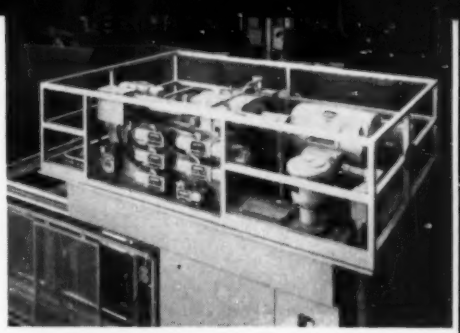
Enclosed feed unit—two-speed and dual-pressure injection control. Weigh feeding attachment can easily be added to any Natco. Scale and dump bucket fit into compartment with standard vibratory feeder; totally enclosed to protect material from contamination.

Two-speed injection control permits high-speed mold filling with slower speed final fill; both speed ranges infinitely adjustable. In addition, pressure can be reduced when mold is filled preventing "packing", reducing the danger of mold flashing and insuring good physicals. The rugged pre-stressed injection yoke eliminates the problems of scored injection plungers and feed bushings.



High melt capacity—"leakproof" heating chamber—plug-in heaters. Large "leakproof" heating chamber has high plasticizing rate, insuring fast cycles. Excellent flow characteristics inside the chamber guarantee minimum pressure drop with good cleaning action.

Color changes normally made in seven to ten shots. Plug-in heating bands are mounted directly on the spreader providing fast heat transfer. Natco's exclusive dual-voltage heat system increases heater life more than ten times and provides closer heat control. Signal lights tell you bands are functioning properly. Either 20,000 or 30,000 psi injection pressure available simply by interchanging injection plunger and feed bushing.



Trouble-free "shockless" hydraulics . . . accessible, yet out of the way. Natco's patented closed-circuit hydraulic system is dependable and trouble-free because it's shockless! It obsoletes traditional open-circuit systems with their hydraulic shock and resulting broken pipes, fractured fittings, oil leaks and other failures. In addition, desirable control features are possible for the first time—two-speed and dual-pressure injection.

Rather than piston-type valves, Natco uses a variable displacement reversing pump. Line pressure is zero at the point of ram reversal; therefore, no shock! Pump shift takes only a fraction of a second. Overhead hydraulic power unit is away from molding room traffic.

The complete Natco Line includes . . .

	NATCO 300	NATCO 400	NATCO 400X	NATCO 800	NATCO 800X
Shot Size, Ozs.—Single Feed	22	28	28	85	85
Melt Capacity (lbs./hr.)	130	165	165	350	350
Platens (inches)	33 x 33	38 x 38	38 x 38	55 x 55	55 x 55
Clearance Between Rods	21½ x 21½	25 x 25	25 x 25	36½ x 36½	36½ x 36½
Clamp Tonnage (max.)	325	*425	*425	850	850
Clamp Stroke (max.)	24"	26"	26"	**40"	**40"
Daylight Opening (max.)	42½"	50"	50"	85"	85"
Injection Speed (cu.in./min.)	1125	1140	2290	2000	4000

*Also available with 550 ton clamp. **Also available with 36" stroke.

PLASTICS MACHINERY DIVISION

National Automatic Tool Co., Inc.

RICHMOND, INDIANA

DISTRICT SALES OFFICES

Chicago 6605 West North Ave., Oak Park, Ill.
Detroit 14119 Puritan Ave., Detroit 27, Mich.
New York 35 Beechwood Ave., Mt. Vernon, N. Y.
Buffalo 1807 Elmwood Ave., Buffalo 7, N. Y.
Cleveland 26 Front St., Berea, Ohio
Boston 336 Washington St., Wellesley Hills 82, Mass.

DISTRIBUTORS

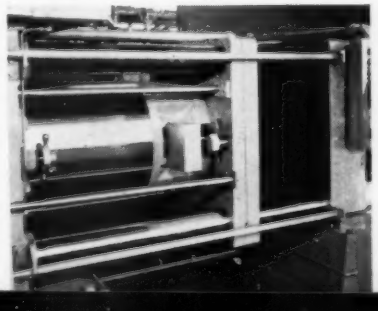
Los Angeles Ellison Machinery Company
San Francisco Harron, Rickard & McCone of N. Calif.
St. Louis Moehlenpah Engineering, Inc.
Pittsburgh Stanley Berg Machinery Company

Convenient clamp stroke adjustments. All mold clamp stroke adjustments are grouped at the front of the machine. Settings can be made simply by moving limit switches. Over-all clamp stroke can be shortened, using only the stroke needed to remove parts from the mold; shorter strokes mean faster cycles!

Three adjustable slow-downs are provided. 1. Slow close prior to mold contact eliminates mold slamming and protects ejector pins and cores. 2. Slow breakaway insures good mold release of the part. 3. Ejector slow down protects part from damage when ejected from mold.

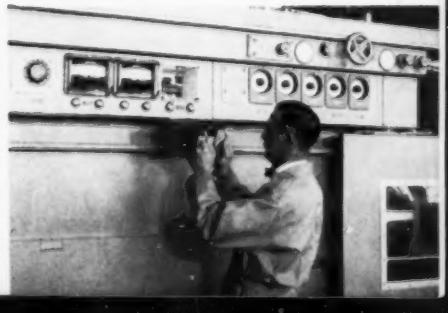
Fast clamp action—large platens—long stroke. Fastest action ever developed for an injection molding machine. Closing speed exceeds 600 ipm—fast pressure build-up. No mold slam or shock. Plenty of daylight and stroke for deep parts as well as shallow—up to 15" extra daylight is available by removing ejector box.

Large platens accurately guided in automatically-lubricated bronze bushings. Extra space for corepulls, water hoses, oversize molds, automatic conveyors, etc. Ejector mechanism can be mounted horizontally or vertically; uses precision bronze-bushed ejector bar.



Convenient plug-in controls. Electric-hydraulic control station is out of the way of traffic, yet convenient. All speeds, pressures, cycle times and temperatures are controlled here.

Both timers and pyrometers are "plug-in" for quick and easy changing; eliminates disconnecting wires. Variac independently controls nozzle heater. Large convenient handwheel regulates injection speed, a direct pump adjustment—no flow control valves are used. Adjustments for mold clamp pressure and injection pressure "drop-off" are also conveniently located here.



Acetate Sheeting...

the perfect plastic material for better packaging. JODA extruded acetate sheets, rolls and film in light to heavy gauges — translucent, transparent or opaque — are excellent for vacuum forming. The unusually attractive stock-size round containers shown are among many made of .0075 JODA acetate by MIRO CONTAINER CO., Brooklyn, N. Y. Note the rich design in the vacuum formed cover — an extra touch that adds to their sales appeal. Increased sales of products packaged in these containers are further proof that "Products Seen Better Sell Better."

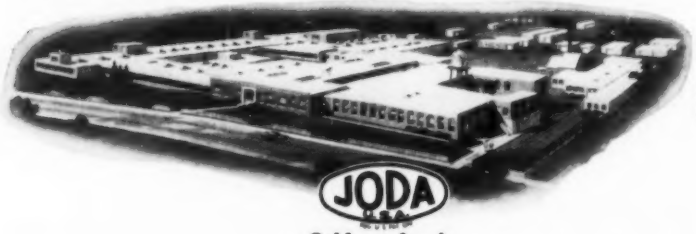
BUTYRATE and LINEAR POLYETHYLENE available in standard sizes.

For information and samples, contact

JOSEPH DAVIS PLASTICS CO.

430 Schuyler Ave.,
Kearny, N. J.

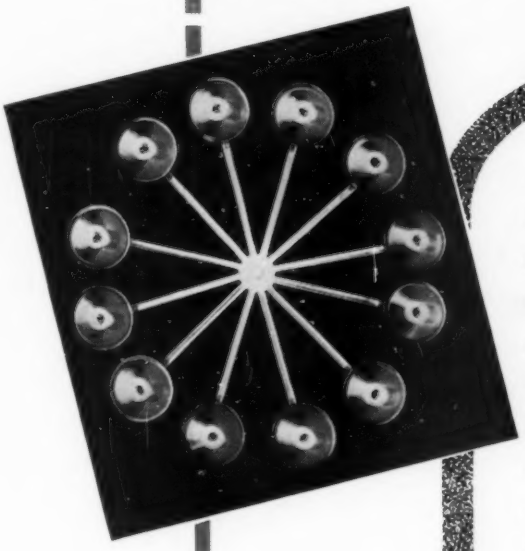
Phone WYman 1-0980-0981
N. Y. BArclay 7-6421-6422



Cable — Insel

Sales Representatives
Conveniently Located.

Polythene cone lined CLOSURES



. . . made by JOHN DALE LTD., New Southgate, London N.11, afford the perfect method of closure. They can be sealed, unsealed and re-sealed by the slightest twist. Though resilient to conform to the mouth of the container they are tough enough for high-speed capping machines. Chemically inert and solvent resisting, the polythene liners must be precision molded to the closest tolerances. For trouble-free rapid precision molding, John Dale Ltd. rely on

DOWDING

600 shots per hour
12 impressions
7,200 liners per hour

Automatic *FAST CYCLING* INJECTION MOLDING MACHINES

Capacity 30 grams · 22 grams in nylon

Write for the New Brochure

DOWDING & DOLL LTD
346 KENSINGTON HIGH STREET · LONDON · ENGLAND
Cables: ACCURATOOL LONDON

140A

VACUUM FORM IN A BIG WAY with HI-FAX®

Now it is possible to combine the economy of vacuum forming with the outstanding properties of Hi-fax high-density polyethylene. These commercially available tote boxes are a good example of how Hi-fax is helping to make good products even better. Rigid, strong, lightweight, resistant to heat and chemicals, the boxes were produced on a fully automatic rotary vacuum forming press.

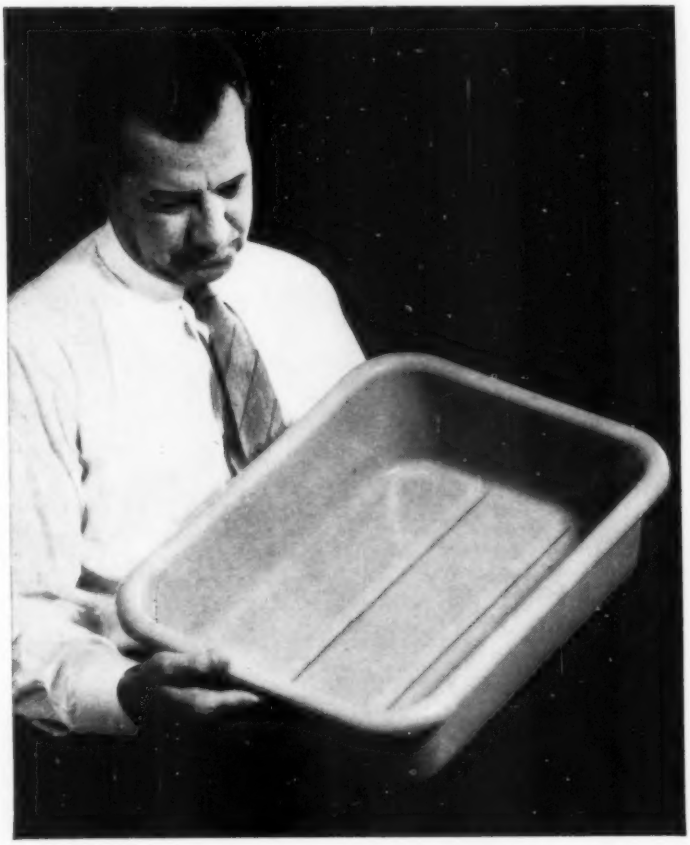
For superior stress crack resistance and toughness more and more manufacturers are turning to extruded sheet based on Hi-fax—the plastic that's different! Perhaps Hi-fax extrusions can provide the solution to your own processing needs. For further technical information, write:

Cellulose Products Department

HERCULES POWDER COMPANY

900 Market Street, Wilmington 99, Delaware

CPS6-7



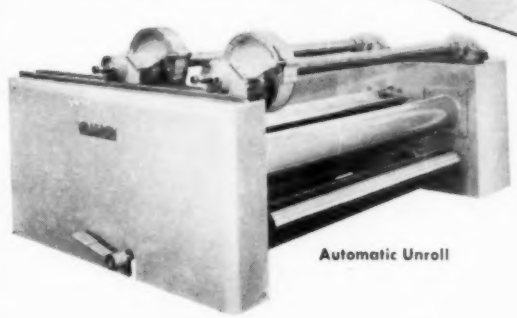
SMOOTH, GLOSSY SURFACE is one of the features of these tote boxes. They are commercially available in two sizes.

RIGID STRENGTH is a "built-in" feature with Hi-fax. Tote box was vacuum formed by **Jewel City Products,** Los Angeles, with sheet extruded by **Jet Specialties Co.,** Los Angeles.

CHEMICAL RESISTANCE to food greases, oils and other corrosive materials makes Hi-fax ideal for products that must withstand unusual conditions.

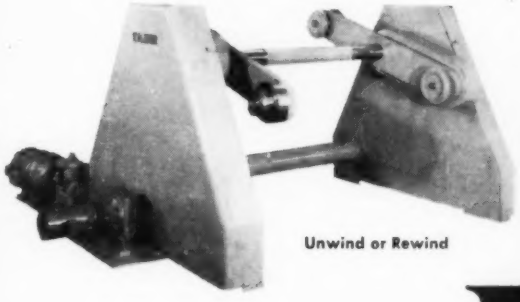
WALDRON

Don't minimize auxiliary equipment ...it deserves careful engineering, too!



Automatic Unroll

Single Drum
Surface Winder



Unwind or Rewind

Because the coater, embosser, gummer, waxer or other processing machine has a direct bearing on the quality of end-product, full attention is given to the design of the unit . . . and rightly so.

Don't overlook the complementing importance of auxiliary equipment, such as:

Unwinds	**Conveyors**
Rewinds	**Cooling Rolls**
Slitters	**Suction Units**

Automatic Web Guides

Improperly designed auxiliaries can impair following operations or undo the good work done previously. Auxiliary equipment is fully as important as the main production unit. Long ago recognizing this, Waldron Engineers sought to design the best possible auxiliary units for handling webs to, through and from the processing machine.

In your planning for that new web processing unit, keep the auxiliaries well in mind. Let us furnish these, too. Then your line will be Waldron throughout . . . a good form of insurance.

West Coast Representative:
Bojanower Machinery Service Co.,
5270 East Washington Blvd.,
Los Angeles 22, California

THE MIDLAND-ROSS GROUP
OF COMPLEMENTING SERVICES

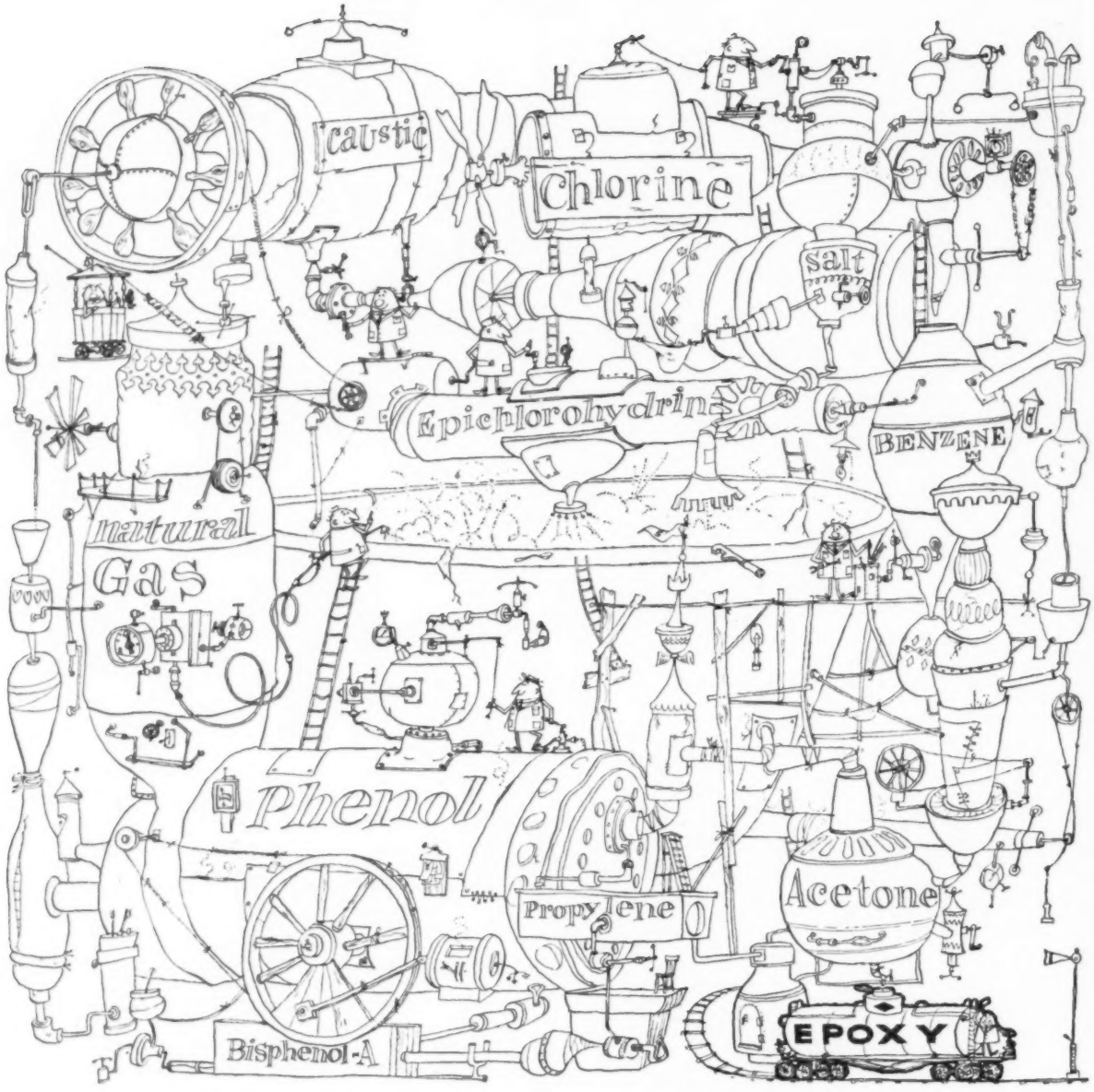
J. O. Ross Engineering, New York
John Waldron Corporation, New Brunswick, N. J.
Andrews and Goodrich, Boston
Ross Engineering of Canada Limited, Montreal
Ross Midwest Fulton, Dayton
Hartig Extruders, Mountainside, N. J.
Carrier Ross Engineering Company, Ltd., England

JOHN WALDRON CORPORATION

Subsidiary of Midland-Ross Corporation

Leader in Web Process Engineering Since 1827

NEW BRUNSWICK, NEW JERSEY
CHICAGO • LOS ANGELES



Dow's basic position in epoxy production assures purity, narrower "spec" range

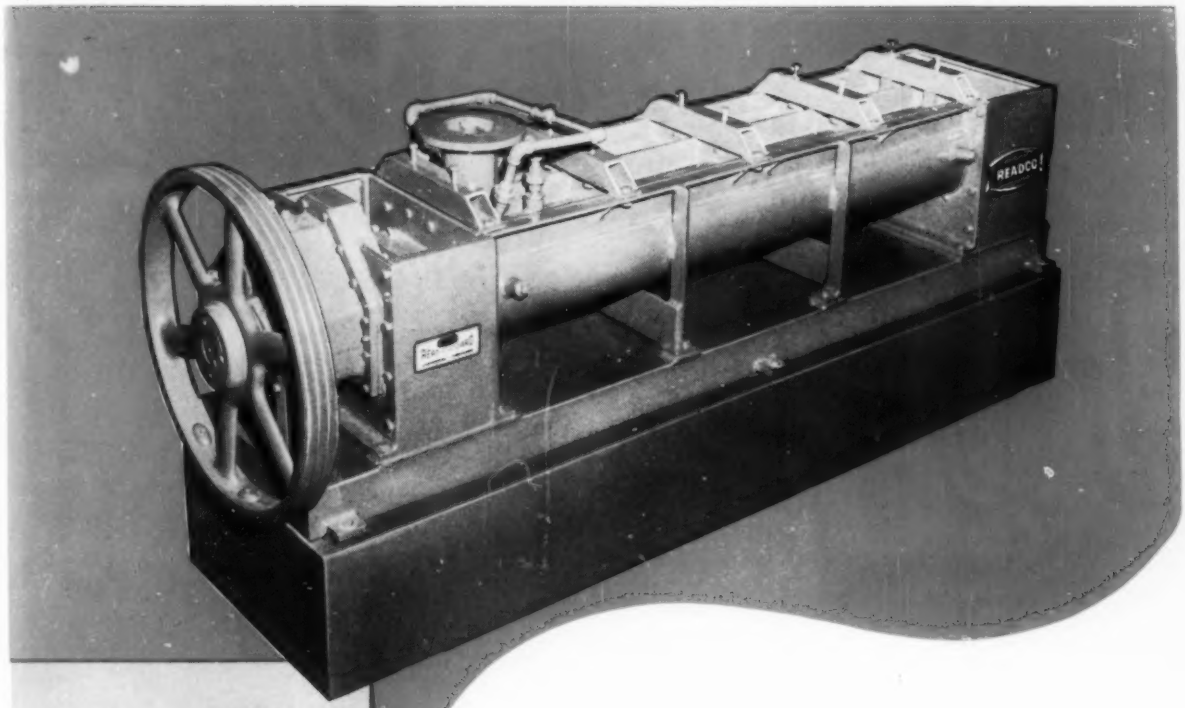
New Dow Epoxy Resins provide outstanding purity because no other company makes so many (more than 93%) of the raw materials that go into them. And the one sure way to control purity of epoxy resins is to make the raw materials in your own plant, under your own supervision.

Purity is only one benefit enjoyed by users of Dow epoxies. Others are: better quality control, narrower range of specifications, an assured source of supply, and versatility of raw materials. The exclusive control of ingredients has resulted in new and improved epoxies such as D.E.R. 332 (new water-clear liquid resin) and Dow's new line of water-white solid epoxy resins.

With years of experience in producing epoxy raw materials, Dow can assure you Dow Epoxy Resins will best meet your highest specification standards. For information or copies of this cartoon contact your Dow sales office. Or write: THE DOW CHEMICAL COMPANY, Midland, Michigan, Coatings Sales Department 2260H.

EPOXY T.M.

YOU CAN DEPEND ON DOW®



READCO

3 CUBIC FEET A MINUTE

Perfectly Mixed!

Speed production, lower costs...automatically with Readco Continuous Double Arm Mixers

You can step up production and reduce costs of processing dense and viscous materials with this rugged Readco mixer. Built for continuous, automatic operation, it will turn out ½ to 3 cubic feet per minute . . . in a completely homogeneous mix.

Overlapping action of mixing paddles fully disperses ingredients while moving them along to discharge. Temperature controlling jackets for heating and cooling are standard equipment.

For further information on Readco mixing equipment, see Chemical Engineering Catalog pages 1483 to 1490.

Whatever the mixing job: a READCO mixer!

READ STANDARD
York, Pennsylvania
A Division of
Capitol Products Corporation

The SPECIAL grades of Erinoid polystyrene

The range of Erinoid polystyrene moulding powders provides materials which meet the exacting requirements of today's most varied applications and manipulation techniques. In this range there is a group of *special* grades giving three outstanding qualities—heat resistance, increased strength (with transparency) and light resistance.

HEAT RESISTANCE

Four grades are available. Each has a softening point of 100°-103°C. and a permanent heat distortion resistance of 85°C.

HS This is the 'general purpose' heat resistant grade.

2CL/HS A high molecular weight polystyrene with an overall 50% increase in strength. Available in all colours, including crystal clear.

CP.20/HS A high-impact polystyrene with exceptional elongation and flexural strength. Its outstanding feature is the very high gloss surface finish obtainable on mouldings.

ACN/HS Styrene acrylonitrile copolymer which has a strength figure 50-100% higher than general purpose polystyrene. It has good resistance to abrasion and crazing. ACN/HS has excellent electrical properties and metal inserts can be moulded in. It is resistant to attack by petrol, white spirit, fruit juices, acids, alkalies, fats, inks and disinfectants. Tea and coffee do not stain ACN/HS.

INCREASED STRENGTH

2CL 2CL/HS High molecular weight polystyrene, grade 2CL, gives 50% increase in strength—*at no extra cost*. This grade is ideal for mouldings which have to withstand flexing, vibration or shock. This increased toughness is achieved without impairing the crystal clarity of the material. It is also available in a heat resistant grade 2CL/HS—see above.

LIGHT RESISTANCE

Colour formulations 3L121 and 3L133 Ordinary grades of polystyrene, particularly in crystal and opal shades, are liable to yellow considerably after about eight months' use. To overcome this, four of the Erinoid grades have been light-stabilised. Erinoid light-stabilised grades resist yellowing for up to 3½ years. In addition to allowing maximum light transmission these grades effectively diffuse the light. The four Erinoid grades available in light-stabilised form are: KLP, 2CL, 2CL/HS and HS.

TYPICAL APPLICATIONS

Electrical coil formers.
Foil for capacitor insulation.

Electrical components.
High-quality monofilament.
Disposable packs, (e.g. for jam, allowing hot-filling).

Vacuum flask cups.
Electric razor housings.
Jelly trays.
Motor car & radio components.

Monofilament.
Oil filter bowls.
Household utensils.
Canteen-ware.
Motor car components.
Office machinery.
Vacuum cleaner components.

Bathroom and kitchen fittings.
Moulded packs.
Radio cabinets.
Monofilaments.

Lighting fittings, including extruded sections and moulded diffuser screens.

These special grades are all available as moulding powder, sheet and extruded sections.

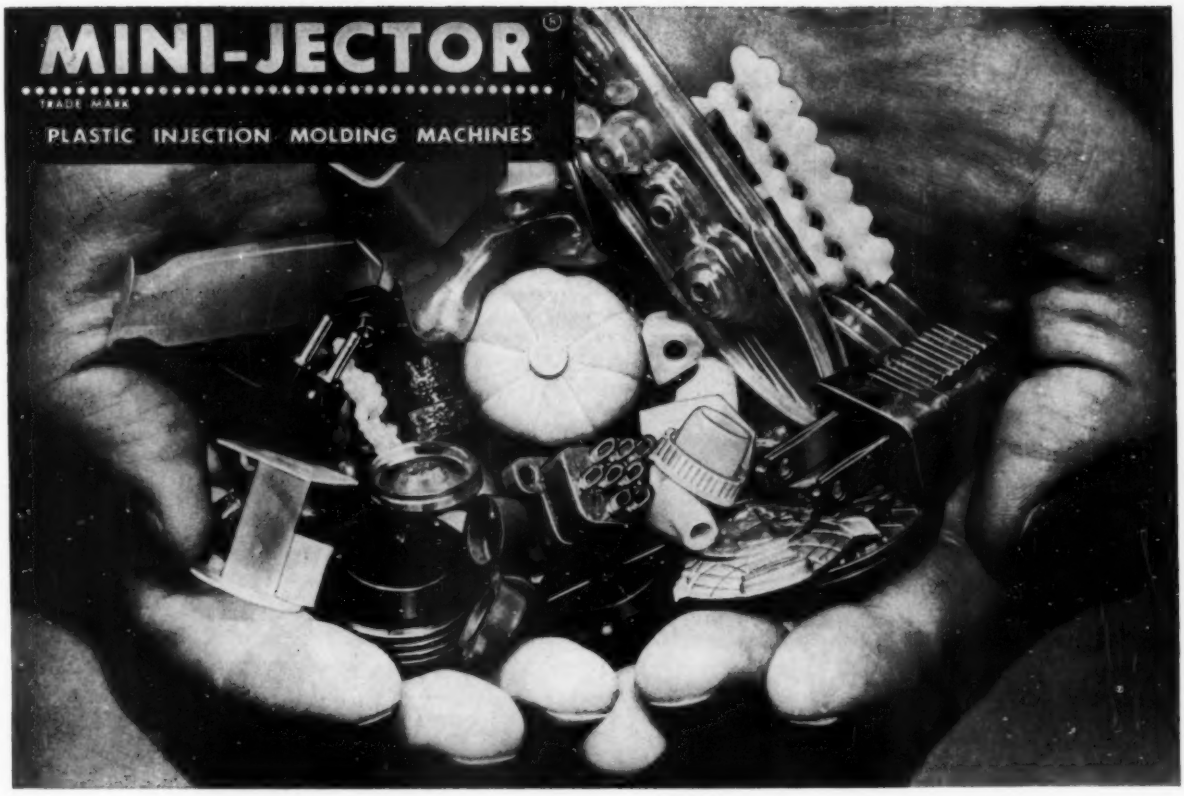
Erinoid polystyrene is manufactured by

STYRENE PRODUCTS LIMITED

Full information, samples, prices etc., on application to

ERINOID LIMITED · STROUD · GLOUCESTERSHIRE

Telephone: Stroud 810



MORE VARIETY at LOWER COST!

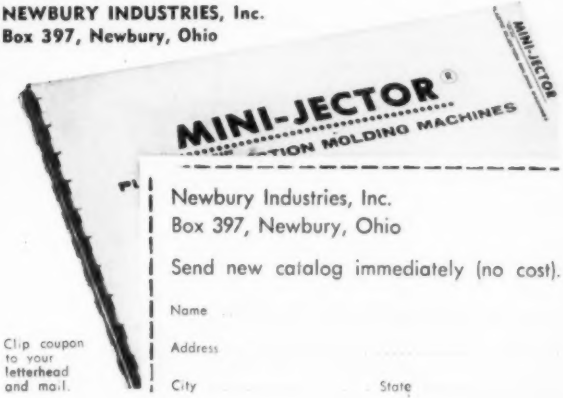
Save thousands of dollars in mold costs with MINI-JECTOR. Eliminate "big press" high-per-piece tooling expenses!

Over $4000 saved on one of the above items alone. Details on request. The more variety, the bigger the savings. Flexible, efficient MINI-JECTOR Plastic Injection Molding Machines answer the critical need for lower cost development and production of fast-changing varieties of small precision-molded plastic items. Savings begin with low initial investment for machine (under $1000) and mold-blanks (as low as $29.50). More important are the major savings in time, trouble and money developing and producing wide varieties of items, by eliminating complex, costly big-press tooling where not required. MINI-JECTOR solves your "tight margin" runs (from test samples to moderate production); also tricky "insert" molding up to 1 oz. capacities in all thermoplastics, **including Nylon.** Compact, simple to operate; lever and push-button control models, air or hydraulic power to fit your facilities.

See complete MINI-JECTOR Line of Machines and Accessories. Illustrated catalog presents detailed specifications; technical data on performance, applications; and the newest developments in plastic injection molding techniques. Shows how MINI-JECTOR has modernized methods in hundreds of plants. **Mai'ed free at your request (send the coupon) to**

(left) **Model 45 "Wasp"** (bench), fast, low-cost insert molding and encapsulating up to 1 oz. (center) **New "Universal" Model** combines features of 4 most popular MINI-JECTORS. (right) **Model 60 "Super-Hornet"** for most economy in moderate, conventional molding. Other models to suit your exact needs. (See catalog.)

NEWBURY INDUSTRIES, Inc.
Box 397, Newbury, Ohio



Newbury Industries, Inc.
Box 397, Newbury, Ohio

Send new catalog immediately (no cost).

Name

Address

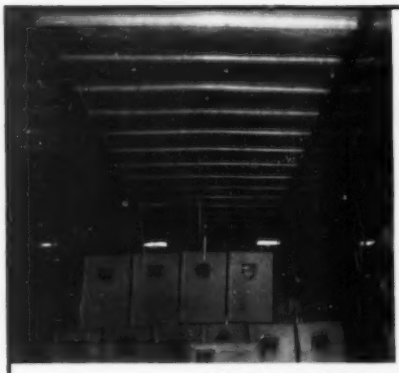
City State

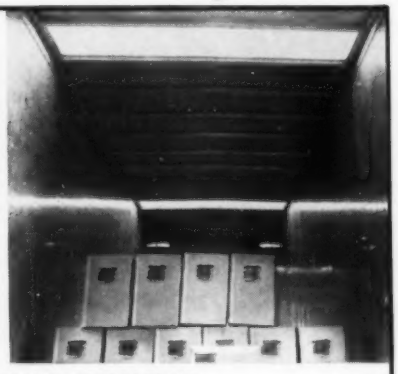
Clip coupon to your letterhead and mail.

Garan® ROVING & RESIN COMBINE TO PRODUCE

Practical New Truck Skylight

Panel Made From Garan Woven Roving Increases Truck Utility by Permitting up to 60% Light Transmission With No Sacrifice of Mechanical Strength in Roof





HERE'S POSITIVE PROOF*

Photograph at left was taken with skylights covered. Front roof caps were left uncovered and one rear door open 12". Light meter reading of 0.2 candle power.

Photograph at right was taken of same trailer with one rear door sealed and second open one foot. No artificial light used. Light meter reading was 3.2 candle power.

*Unretouched photographs taken by Fruehauf Trailer Company, Detroit, Michigan.

Garan Woven Roving produces laminates having uniformly high physical properties.

Fiber Glass Industries, Inc., Amsterdam, N. Y. produces Polyply Skylights in widths of 19 and 25 inches, in lengths of 90 to 94 inches with three layers of resin bonded ROVCLOTH molded to the panel's metal frame.

Another efficiency problem in multi-stop trucking operations has been solved – thanks to the unique characteristics of Garan Roving, pioneered by L·O·F Glass Fibers Company.

Diffused light into truck trailer working areas now permits sorting, checking and delivery organization without moving items to the door for label reading.

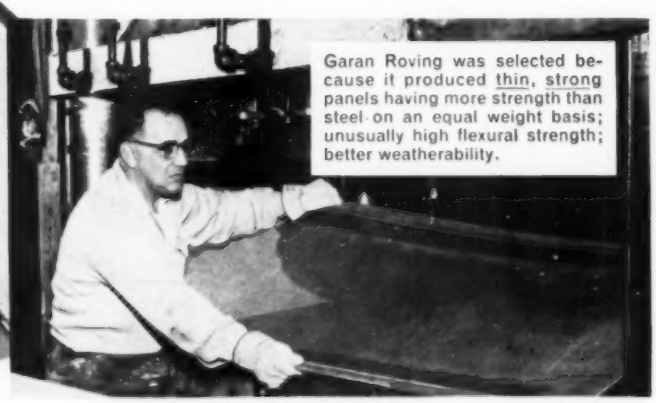
WITH GARAN WOVEN ROVING YOU GET:

faster wet-out . . . better bond . . speedy production.

improved flexural, compressive and tensile strengths.

high wet-strength retention . . . added durability.

Because Garan Roving is made by the marble process, it permits clearer, color-free laminates . . . a feature of great importance in applications where translucency is required.



Garan Roving was selected because it produced thin, strong panels having more strength than steel on an equal weight basis; unusually high flexural strength; better weatherability.

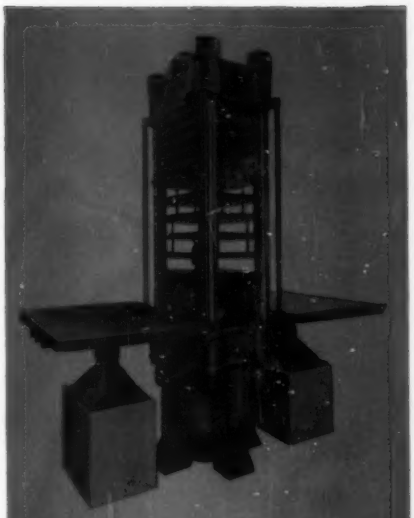
L·O·F GLASS FIBERS

For technical information about Garan Roving and how it can help improve your product . . . open new markets, call our nearest sales office, or write: L·O·F Glass Fibers Company, Dept. 1810 Madison Avenue, Toledo 1, Ohio

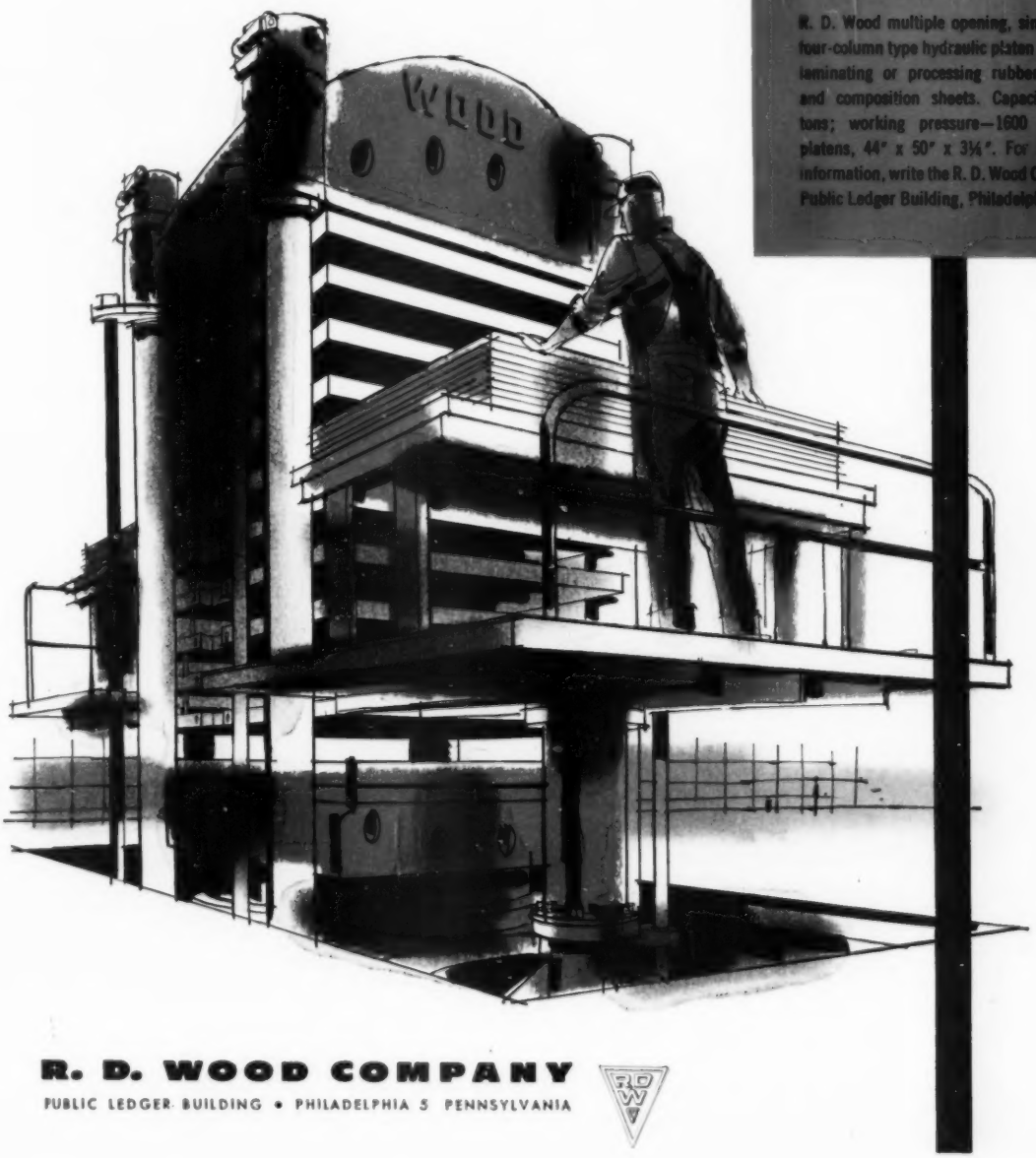
L·O·F GLASS FIBERS COMPANY
TOLEDO 1, OHIO

Quality is never sacrificed

When you look at a new R. D. Wood press, you find every recent advance in press control and operation to meet the needs of today's automated production techniques. Yet there has been no sacrifice in basic design strength and rigidity so important to maintain continuous production runs. For example: the original model of the press shown below was built 25 years ago and is still in full operation. If you bought a Wood Press today, you'd receive the same fine quality which provides longer life . . . less maintenance. This is the type of service you expect when you buy a Wood Press.



R. D. Wood multiple opening, single ram, four-column type hydraulic platen press for laminating or processing rubber, plastic and composition sheets. Capacity—1230 tons; working pressure—1600 psi; 11 platens, 44" x 50" x 3¼". For complete information, write the R. D. Wood Company, Public Ledger Building, Philadelphia 5, Pa.



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A. Schulman, Inc., is an old hand in the processing of Polyvinyl Chloride and Polyethylene for extrusion and injection moulding. Hundreds of manufacturers are saving money on the EXACT type of plastic they need, supplied by A. Schulman, Inc. Let us know your requirements, perhaps we can help you keep production and quality up — while costs go down.
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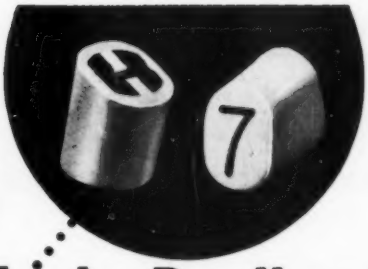
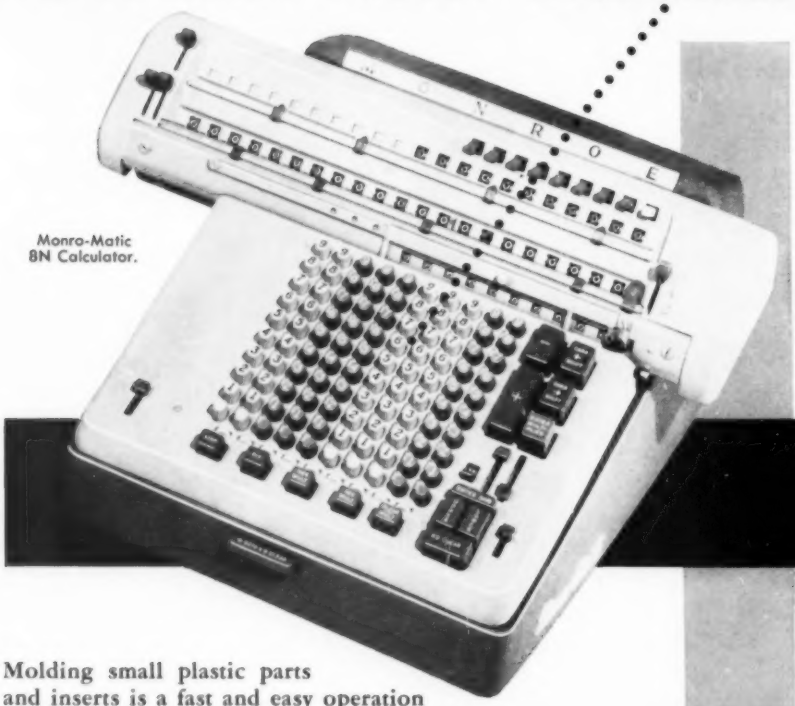
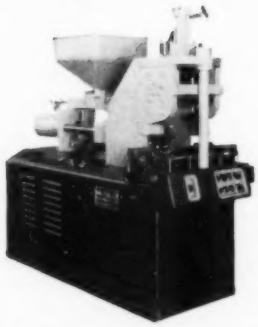
Monroe Molds Inserts Better and Faster with Moslo Duplimatics

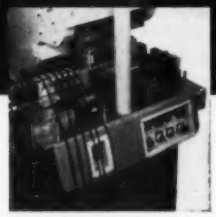




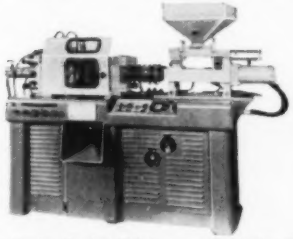
Monro-Matic 8N Calculator.



Cord Plug and Insert Molding is easily done on the Moslo 3-ounce Duplimatic.



The 2-station shifting table on the Duplimatic permits loading one side while parts are being automatically molded on the other side.



The Moslo Model 75-4 ounce and the 74-2 ounce are completely automatic plastic injection molding machines. Used in conjunction with the Duplimatic they make an ideal combination for insert molding.

Illustrated are keys for a Monroe Calculator. The insert work on these was done on the Moslo Duplimatic.

Molding small plastic parts and inserts is a fast and easy operation with Moslo plastic injection molding machines.

One leading manufacturer, Monroe Calculating Machine Company, Inc., has put the Moslo Duplimatic to good use in producing multi-colored keys for their calculating machines. The pre-molded plastic letters and numerals are placed on the Moslo Duplimatic. In one completely automatic operation, the second color is molded around the insert.

The letters, symbols and numbers become an integral part of each key—giving years of service and permanent readability.

This is just one example of how Moslo machines are cutting production costs and producing a better product through plastic injection molding.

Moslo machines are ideally suited for an infinite number of applications. If your manufacturing requires small parts or insert work, we will be glad to demonstrate how Moslo equipment can help you do a better job.

Our sales and engineering staff is available without obligation. We cordially invite your inquiry. Financing plan available.

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MACHINERY COMPANY
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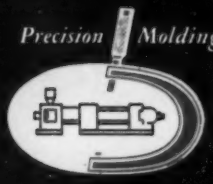
give your plastic products the benefit of the

MAKRAY ok

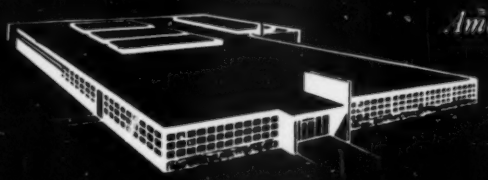
Precision Molding



The Makray "OK" on your product is the result of a unique system of engineering, designing, molding and assembly room techniques that result in the best in plastics technology. But, while we are unique in the quality of painstaking craftsmanship and inspection that we apply to your products, we are completely competitive in price. Whether we originate the design or work from yours our objective is the same: To give you a plastic product that looks better, works better and sells better.

When you are in or near Chicago come out and visit us. You'll see why results are finer from America's finest injection molding plant. Or, call or write today for the complete story on the Makray "OK"

Precision-molded plastic expansion WALL PLUGS for mounting pictures, mirrors, towel bars, etc.



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- 24-hour operation assures speedy delivery
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- Precision molds designed and built in our own shop
- Complete engineering service to serve you . . . save you money

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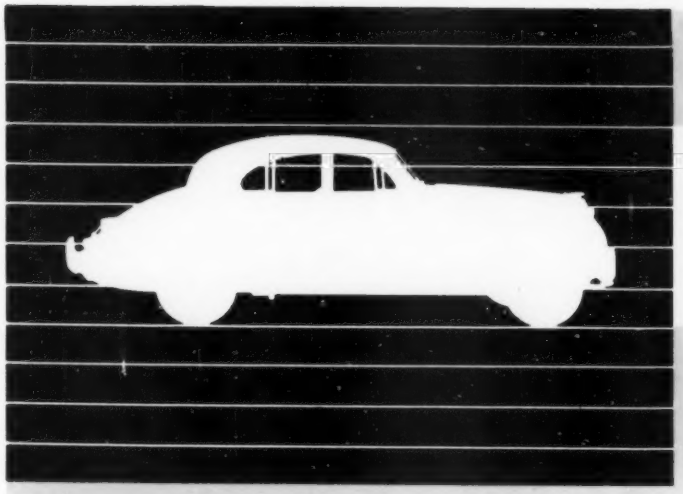

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There's a hidden ingredient in every Argus product. It's the basic, bred-in-the-bone curiosity about your problems that enables Argus research to keep turning out better and better vinyl plasticizers and stabilizers at lower and lower cost.

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If you want the *right* answers, ask Argus. We'll find them for you in our regular line of Mark stabilizers and Drapex plasticizers — or in basic, original research done on your product by our Technical Service Staff. Write for technical bulletins and samples.

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FELLOWS 6-200 INJECTION MOLDING MACHINE

It's designed for versatility: attachments can be incorporated in the Fellows 6-200 to give you just the degree of automatic operation you need! A wide range of attachments permits full-automatic molding of many products that used to present problems, such as parts with internal and external threads, undercuts and side cores.

Whether you use it for partial or full-automatic molding, Fellows 6-200 pays off in increased production, fewer rejects, lower unit costs. Sensitive, dependable controls simplify set-ups and change-overs as well as operation, even on the most difficult jobs. You get dry-run speeds from 490 to 650 cycles per hour, shots up to 9 ounces with the optional pre-pack device.

Ask your Fellows representative for information about the cost-cutting Fellows 6-200 plastics injection molding machine, with or without optional attachments. (And ask him about the Fellows Plans that let you pay for your machine while it earns.) Just contact any Fellows office.

Fellows
injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY, Plastics Machine Division, Head Office and Export Department: Springfield, Vermont
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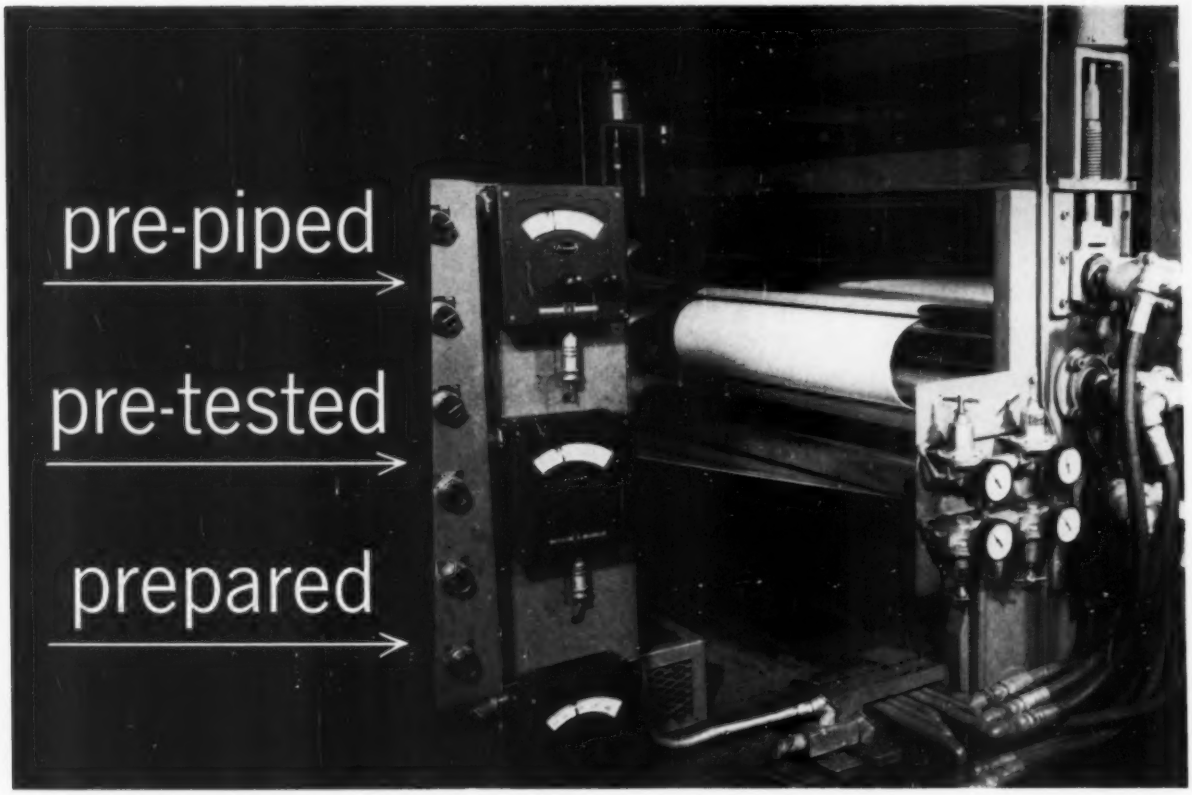
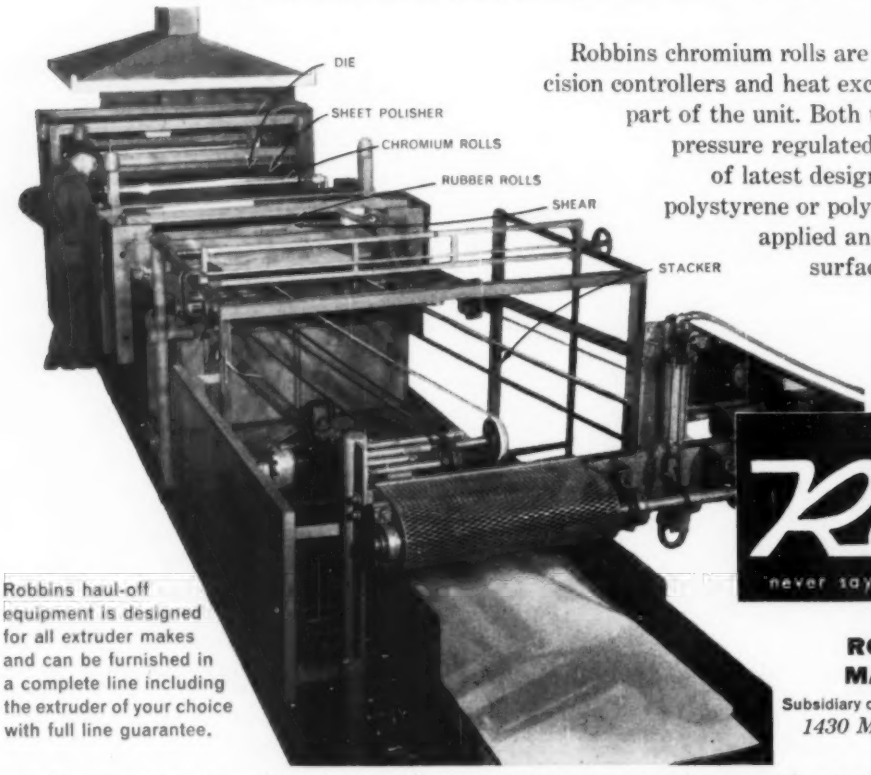


Robbins Chromium Roll Sheet Haul-Off Unit is completely pre-piped with temperature controllers, heat exchangers, pumps and all electrical work finished and ready.



Robbins chromium rolls are heated and cooled. Precision controllers and heat exchangers are an integral part of the unit. Both top and bottom rolls are pressure regulated with automatic devices of latest design. Decorative overlay of polystyrene or polyester films can be easily applied and calendered. Embossed surfaces can be produced too.

Please write

Robbins haul-off equipment is designed for all extruder makes and can be furnished in a complete line including the extruder of your choice with full line guarantee.

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never say die . . . say Robbins die

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Subsidiary of Lynch Corp., Anderson, Ind., U.S.A.
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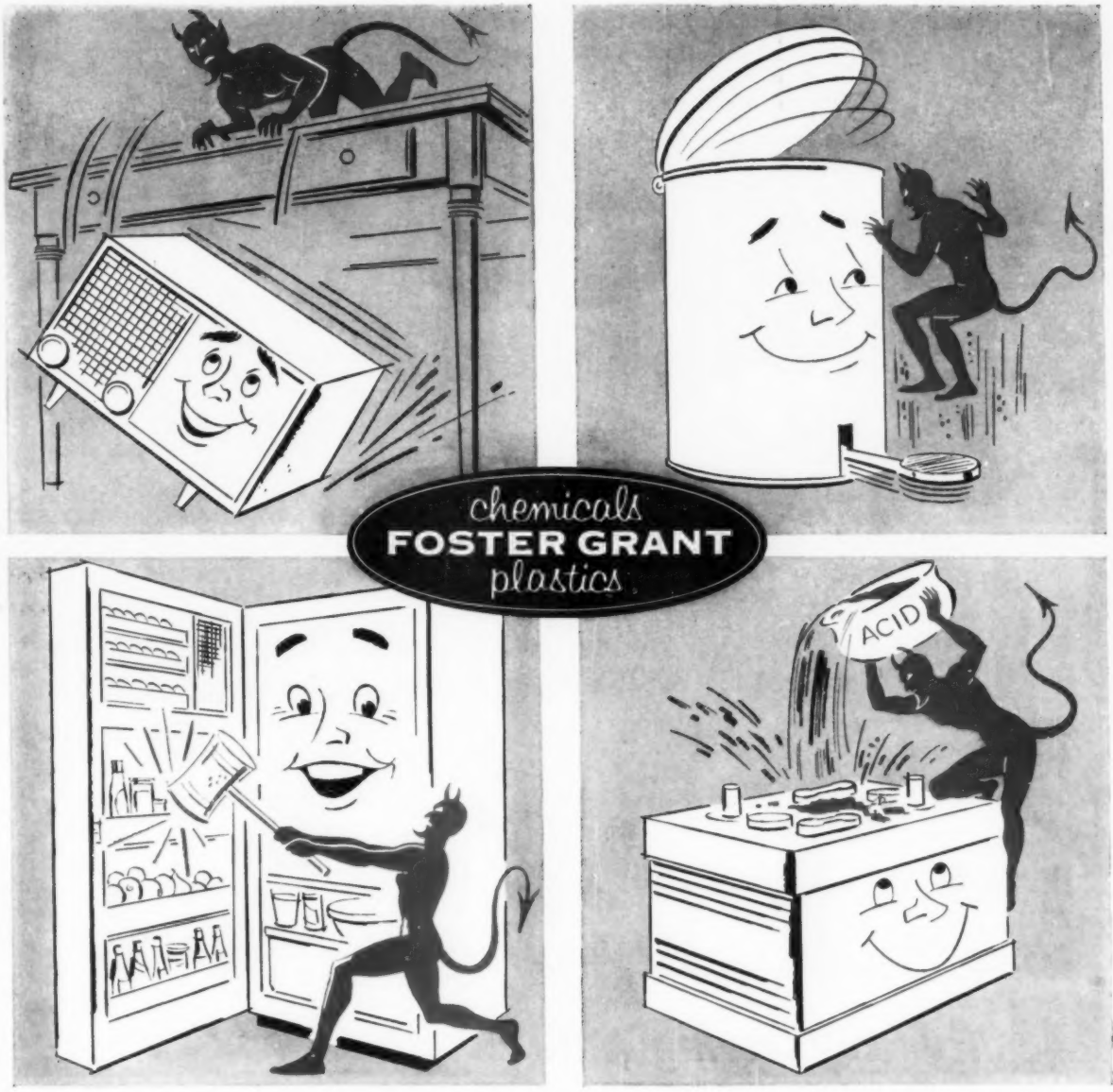
from die to sheet stacker **ROBBINS** engineered and **ROBBINS** built



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This outstanding impact polystyrene cannot be excelled for toughness, flexibility, heat resistance, superior moldability and vacuum forming qualities. As a graft copolymer it represents a new approach to the manufacture of these resins. It assures the extruder a gel-free product that yields a sheet with no surface blemishes or orange peel.

The molder receives a completely homogeneous plastic with consistent uniformity, combined with freedom from weld line problems.

Both the molder and extruder will appreciate its transparency, gloss and ease of pigment dispersion.

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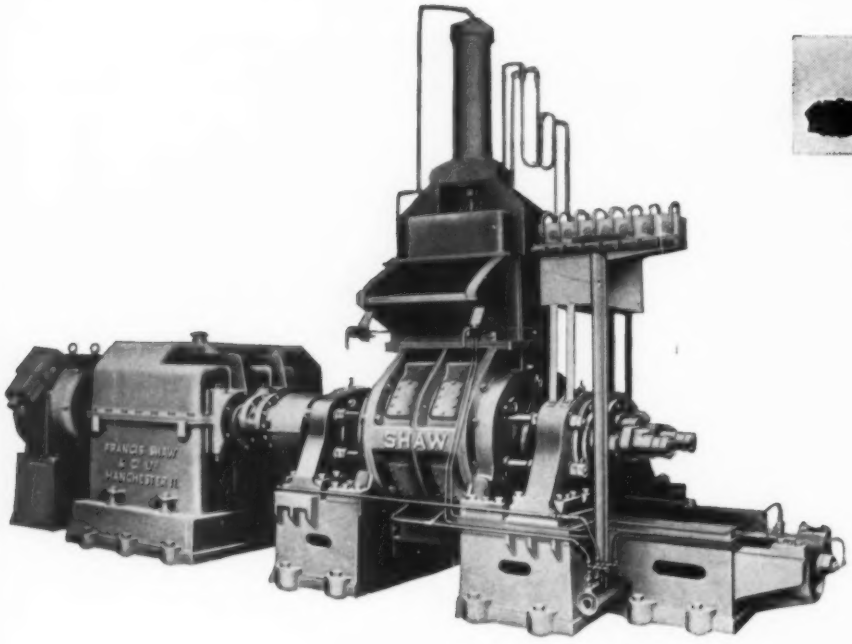

INTERMIX. A robust high efficiency ... duty Internal Mixer for mixing plastic compounds at lower-than-normal temperatures. It is supplied with steam heating for plastics and other materials, and the exclusive rotor design ensures consistent high quality mixing.

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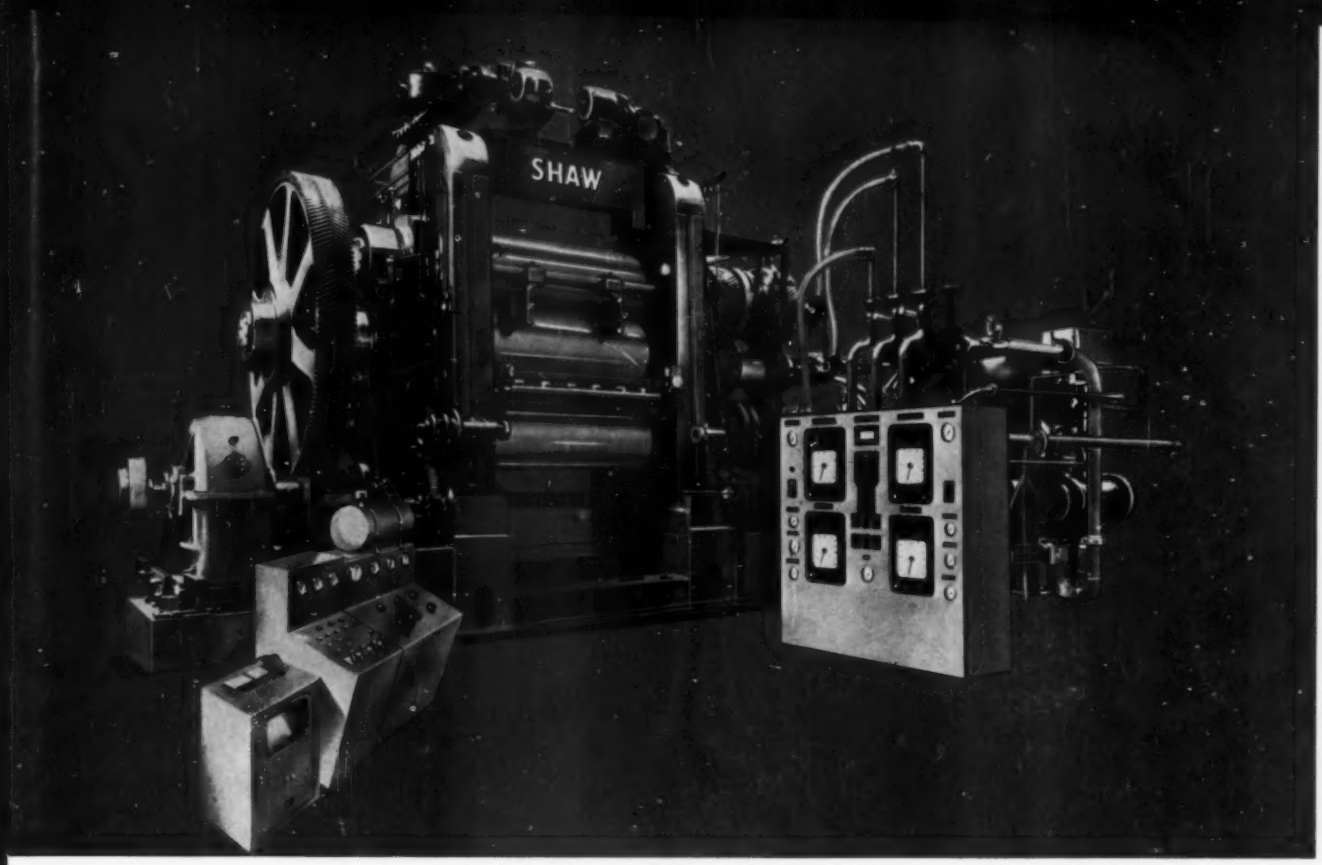
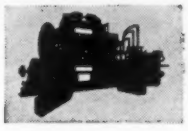
Close-limit accuracy and rigorous inspection during manufacture guarantee to the user a consistently high quality output from Francis Shaw equipment.

Francis Shaw are available for the design, manufacture, and installation of a wide range of processing equipment

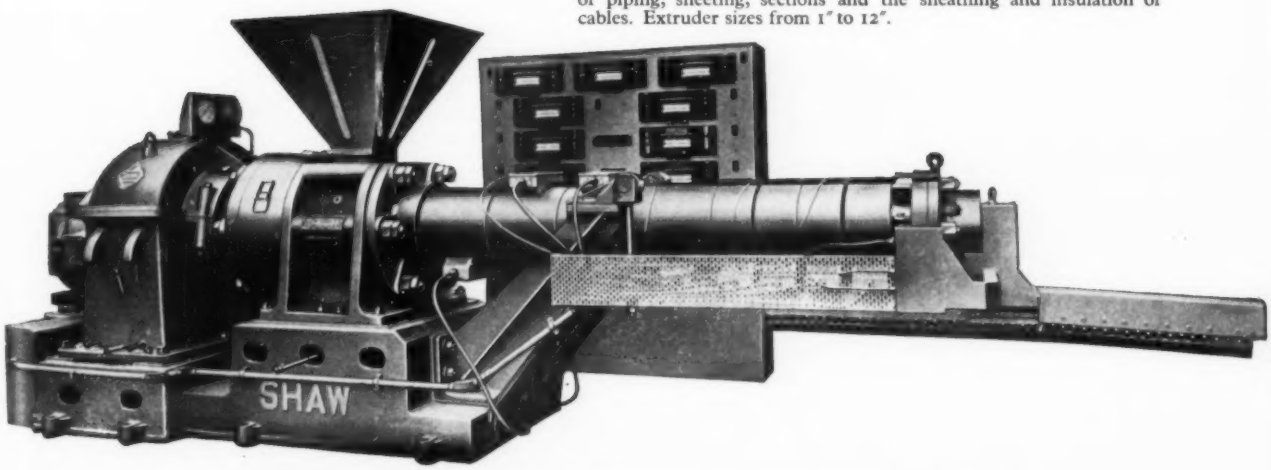




CALENDER. A comprehensive range of Francis Shaw Calenders is available for the processing of all rubber and plastic materials. Flood lubrication and hydraulic roll balancing available on all production sizes. Roll Bending can be fitted as an additional refinement. All sizes available from 13″ x 6″ to 92″ x 32″. Two-, Three- and Four-Bowl Designs.

QUALITY ENGINEERING FOR QUANTITY PRODUCTION

PLASTIC EXTRUDER. Fine temperature control is a vital feature of Francis Shaw extruders. All-electric heating in separate zones is provided, each zone being separately controlled by proportioning instruments. A wide range of screw and die designs is available for the production of piping, sheeting, sections and the sheathing and insulation of cables. Extruder sizes from 1″ to 12″.



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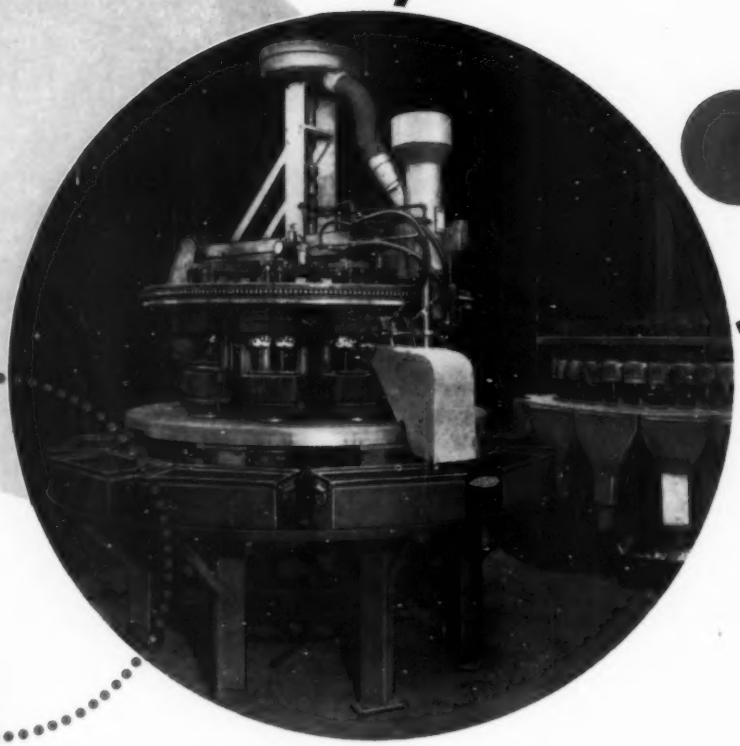

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ROTARY PLASTIC MOLDING PRESSES

- LOW COST, AUTOMATIC CONTINUOUS MOLDING
- AMAZINGLY FAST

NEBUTTCO Rotary Plastic Molding Presses, using thermosetting compounds, bring new economics in the production of small plastic parts. Made with ten or thirty stations, the presses use single- or multiple-cavity molds and continuous rotary operation assures high production.

Originally designed and patented by the General Electric Company, these rotary presses are used for the mass production of molded parts used in wiring devices, and they can be adapted for a wide variety of other plastic products.

By agreement with the General Electric Company, the presses are manufactured in the modern plant of the New England Butt Company, producers of quality machinery since 1842.

The New England Butt Company's experience in building special machinery assures trouble-free operation, and enables us to stand behind the performance of these presses.

Sales and service of the presses are handled by New England Butt Co. Send for descriptive bulletin.

NEW ENGLAND BUTT CO.

Division of Wanskuck Co.

304 Pearl Street • Providence 7, R. I.

Continuous Rotary Operation

10-station press is equivalent of 10 small molding presses, yet occupies floor space of but 2 average presses.

High Production With Low Cost Molds

Eliminates expensive frames and costly multiple-cavity molds. 30-station press produces average of 30 parts a minute with single-cavity molds: 60 parts with double-cavity molds and up to 90 parts a minute with triple-cavity molds.

Flexible

Up to 30 different molds can be used at one time in 30-station press, provided all use same molding compound and require approximately same curing time.

Completely Adjustable

Thermosetting compounds are hopper-fed and precisely metered by drilled plugs in plate, conserving compound and minimizing flash.

Low Maintenance Cost

Low molding pressure greatly reduces possibility of double loading, pin breaking, etc.

Separate Thermostats

Curing temperature for top holders can be set above or below that for bottom holders. Also, three zone thermostats permit varying curing heat for different molds.

Safety Features

Simple screw valve adjusts curing time by changing speed of rotation. If hydraulic system fails, this control instantly shuts down entire press.

Don't miss . . . in this issue

Because of the great variety of plastics used in coatings, and because of the wide range of available plastics and non-plastics web materials, there has been a lot of confusion concerning the best method and the best kind of equipment to use for making a specific coated end product. Here, for the first time anywhere, one of the outstanding authorities in the field has listed and analyzed the various coating methods, and next month will present a chart to enable readers to make sound decisions in the selection of coating methods. See p. 91.

Simplified shipping at lower cost. Of special interest to shippers of bulk foods, acids, and other "problem" materials is the recent introduction of a number of shipper-liner combinations. The plastics materials involved are vinyl, polyethylene, and phenolic. One such shipper even becomes a dispenser at retail storage battery outlets. Details of the new shipping combinations are given in "Latest in liners," p. 106.

Plastics skeletons for students. One of the first mass-production jobs for which high-density polyethylene was selected is a miniature skeleton made of 16 separate injection molded components. The price of the product is under $5, which compares with previous models selling for $100 or more. Developed for medical students and doctors, the thing has now become a hot item in the toy and hobby field. For the whole story read "Small skeletons for mass markets," p. 100.

Keep your eye on composite structures. Designers have often rejected plastics as materials of construction because of their relatively low stiffness. However, it has often been overlooked that plastics can easily be shaped into attractive forms that offer plenty of stiffness, cost less, and weigh much less than their conventional counterparts in other materials. Simple composite structures, too, can offer great rigidity at low cost. If your product needs to be stiff, see "Designing stiffness into plastics structures," p. 123.

Bigger shots, better pieces, lower costs in injection molding. A new technique of injection machine operation, "precompressed molding," takes advantage of the inherent compressibility of plastics melts to get extra fast filling and larger effective shot capacity at close to minimum shot weight. Quick opening valves, which replace conventional gates, eliminate much of normal ram-forward time, permit ram to make most of its motion while piece hardens in mold. See "Valve gating of injection molds," p. 117.

Economy and efficiency with nylon tubing. Replacing metal tubing in pneumatic and lubrication systems on vehicles and on machines, nylon tubing has many advantages. It resists vibrational fatigue, provides corrosion resistance, makes for easy installation. For a review of the latest developments in the field, see "New jobs for nylon tubing," p. 102.

New plastisol-coated metal sheets. Supplementing the widely accepted laminating of vinyl on metal is a new method of coating steel and aluminum sheet with plastisols to provide a composite material which can be fabricated on standard metalworking equipment. The new method promises to bring new economies and to enlarge the total market. The whole proposition is outlined in "Fine future seen for plastisol-coated metal sheets," p. 96.

Reinforced plastics TV cabinets. Premix made from polyesters, fibrous glass, sisal fiber, and color is used to mold a new line of portable television cabinets. Product is made in three parts, weighing a total of 7½ lb., stands up to all Underwriters' tests. Read "Better cabinets for TV portables," p. 110.

Formed plastics invade garden tool field. The use of formed ABS copolymer sheet made possible a grass catcher which attaches to a rotary lawn mower. Strength, light weight, and color were factors in selection of the material. The design and production problems are discussed in "ABS grass catcher," p. 105.

Watch for . . . the second half of the presentation on how to select the best coating method and equipment for a given end use . . . unique applications of extrusions . . . new developments in specialized foam plastics . . . a comprehensive picture of the polyolefins and what is happening to them . . . and the fabulous November pre-Plastics Exhibition Show issue, the theme of which will be "Plastics for Profit," and which will contain a score or more of articles pointing up applications in which the use of plastics has lowered the product cost, improved product performance, or enhanced product distribution.

MODERN PLASTICS*

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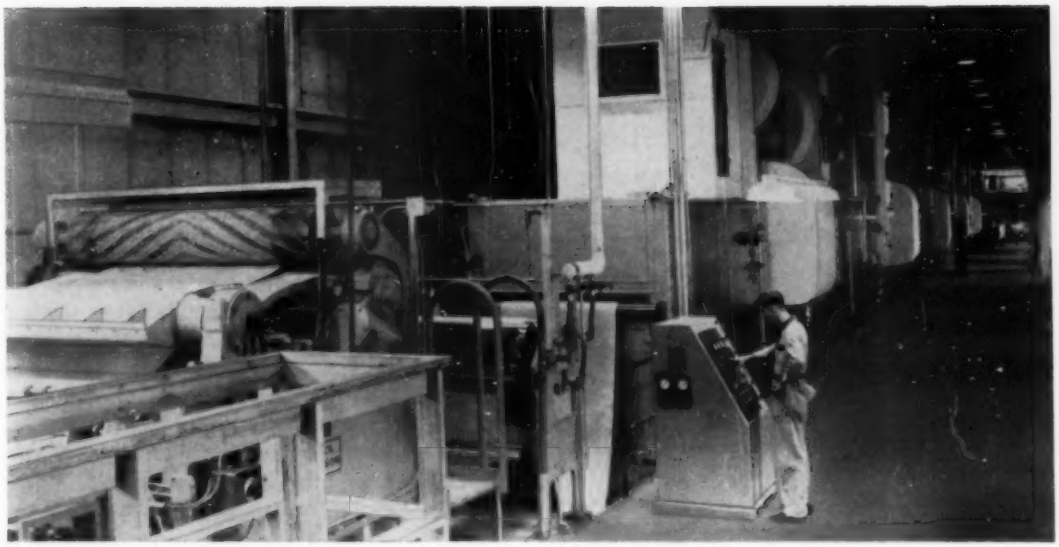
September
1958
Number 1



Latest saturation (dip) coating line in the plastics industry is used for producing plies for Formica high-pressure laminate. View above is from the cutter end of the line. (Photo, Dilts Div., The Black-Clawson Co., Inc.)

Take your choice of

COATING METHODS

*By George L. Booth**

OF GREAT IMPORTANCE to the plastics industries is the coating of plastics and resins on flexible supporting webs, which themselves may or may not be plastics. But the materials used, and the methods by which they are brought together, vary so greatly in physical characteristics that the problem of selecting a coating method for a given application becomes highly complex.

This two-part article has been prepared to resolve some of that complexity. Every known method of applying coatings to webs will be briefly discussed, with greater emphasis on the more widely used and versatile processes. A chart accompanying the second part, to be published next month, will give the key to the whole situation. With it, knowing the product in prospect, and the web and coating to be used, it will be possible for the reader to select, at least in a preliminary way, the best method of reaching the desired end result.

For the purpose of this discussion, coating methods will be classified according to six basic types of equipment:

1) Roll coaters, including reverse-roll coaters, kiss coaters, nip coaters, gravure coaters, bead coaters, and dip coaters (saturators).

2) Post-metering and/or smoothing devices, including both rigid and flexible knife coaters,

* See box p. 95.

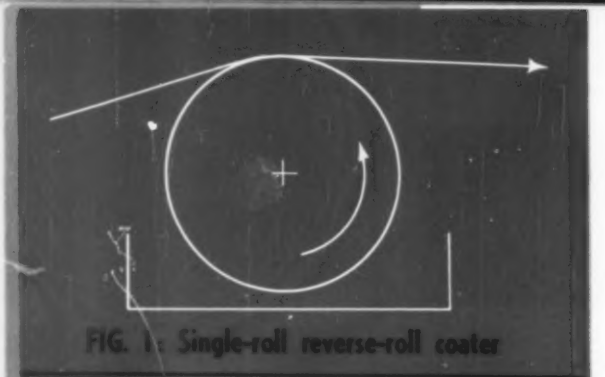


FIG. 1: Single-roll reverse-roll coater

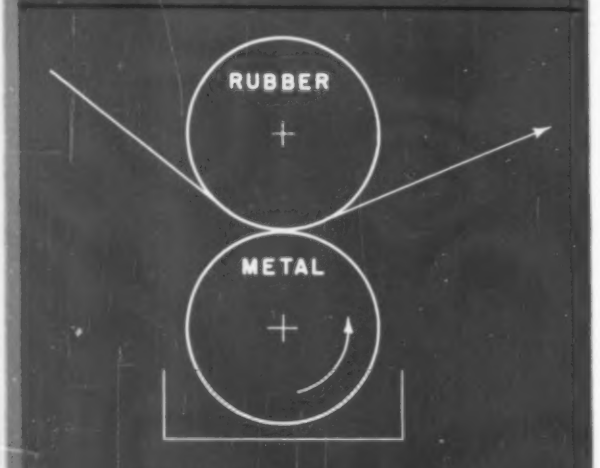


FIG. 2: Two-roll reverse-roll

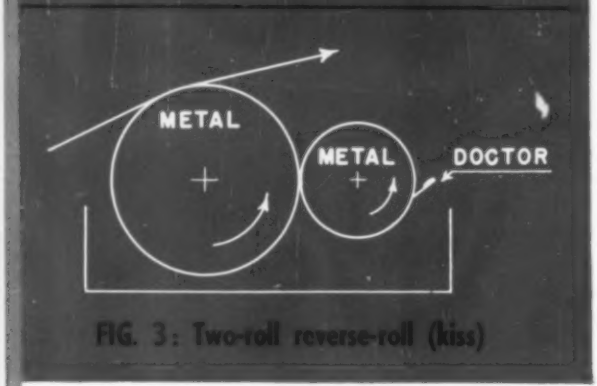


FIG. 3: Two-roll reverse-roll (kiss)

round bars, wire-wound bars, bull noses, air doctors, and brushes.

3) Spray coaters, including the Bracewell type, which spray either directly onto the web or onto the roll for transfer.

4) Extrusion coaters, including those used for polyethylene, vinyl, and cellulosics.

5) Cast coaters.

6) Calender coaters.

Roll coaters will be discussed in this article; the remaining types will be covered in the concluding part next month.

Reverse-roll coaters: The simplest type of coater can be considered a kiss coater as well as a reverse-roll coater (see Fig. 1). It is simply a single roll which runs in the reverse direction to the web and applies a relatively indeterminate amount of coating. This equipment exerts very little control of coating weight, and so is limited to rather watery coatings. It is more used for wetting paper than for actual coating applications.

Another reverse-roll coater is a two-roll type with a backup roll, as shown in Fig. 2. This arrangement tends to clean the reverse-running roller more thoroughly than does the single-roll device. Again, however, the field of use is limited because of the lack of metering control.

A third basic method, sketched in Fig. 3, uses two rolls mounted side by side and both rotating in the same direction but opposite to the web travel. Some control of coating weight is provided by regulating the gap between the two reverse-running rolls. Of course, the relative speed of the rolls and of the web, as well as the viscosity of the coating, will all influence the coating thickness.

One of the limitations in this method is that the web tension must be kept constant to insure that the roll will be completely cleaned by the web. This can be done with a back-up roll, as shown in Fig. 4. The coating is supplied from a pan in which roll *B* picks up the coating, which is then metered in nip *B-C*. A doctor on roll *C* removes the excess material so that the surface of this roll will be clean when it arrives at the nip. The actual application of the coating is accomplished in nip *A-B*. This type of coater is used principally for application of vinyl dispersions, vinyl and other lacquers, and other types of vinyl coatings to paper and fabric. It is not especially suited to high-speed coating work because of the likelihood of severe splash problems at roll *B* and squirting of the coating material out the side of the nip at high speeds. Also, it is difficult to control an uncoated margin on the sheet because in practice edge doctors or dams must be located on roll *B* underneath the nip in a rather inaccessible spot.

The nip-fed, three-roll, reverse-roll coater is shown in Fig. 5. This is an improvement over the pan-fed, three-roll, reverse-roll coater just described and it has the following additional advantages:

1) A smaller amount of coating is employed in the nip than in the pan.

2) The coated width or dry edges can be controlled by placement of edge dams and consequent confinement of the coating.

3) Higher speed can be attained for a given

coating because the coating will not squirt out the edges of the nip.

One particular disadvantage of this coater is poorer visibility of the actual coated surface since the rubber back-up roll is underneath the coater.

The last type of reverse-roll coater to be discussed is the patented four-roll, pan-fed, reverse-roll Contracoater shown in Fig. 6. It incorporates all of the desirable features of the above described coaters and adds some of its own. First, visibility is excellent since the web material is on top rather than on the bottom. Second, a pan is used with a feed roll, which greatly reduces the speed of the roll running in the coating material, and eliminates air entrainment as well as possible damage to the accurate chilled-iron rolls by doctors. Third, no edge dams are required, which further contributes to protection of the expensive chilled iron rolls.

The last two coaters described can handle coatings in the neighborhood of 75,000 cp. viscosity provided that these coatings are relatively thixotropic. Ordinarily these coaters can apply coatings ranging in thickness from less than 1 mil to approximately 20 mils in one pass. They have one disadvantage in that they cannot be used to process open-weave fabrics because of strike-through to the rubber roll. Further, they tend to reproduce any contours on the substrate; on coarse fabrics, for example, it can be assumed that the coating will be correspondingly coarse.

The advantages of reverse-roll coaters are primarily that they can apply an extremely wide range of coatings at speeds in excess of 600 ft./min. in some applications. Further, on a reasonably flat web they deposit a smooth coating that does not require additional smoothing after application. This is extremely important with highly thixotropic materials because the coating thickens soon after the web leaves the regions of high shear stress (the nip, etc.).

Kiss coaters: A kiss coater applies material to a web without the use of a back-up roll for the web. Generally, kiss coaters are used as adhesive applicators and not as coaters in a strict sense. Further, most kiss coaters employ some means of premetering (as in Fig. 3) or post-metering.

As stated, the first description above of a reverse-roll coater also covers the simplest type of kiss coater. The roll can be rotated in the direction of web travel as well as in reverse. Most kiss coaters employ a two-roll system,

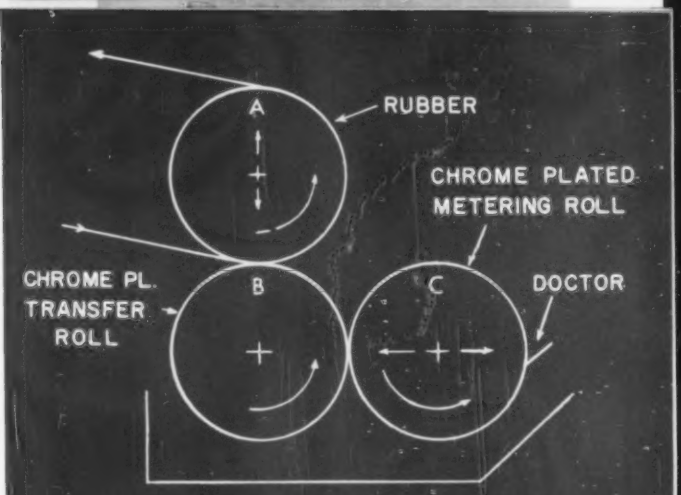


FIG. 4: Pan-fed three-roll reverse-roll coater

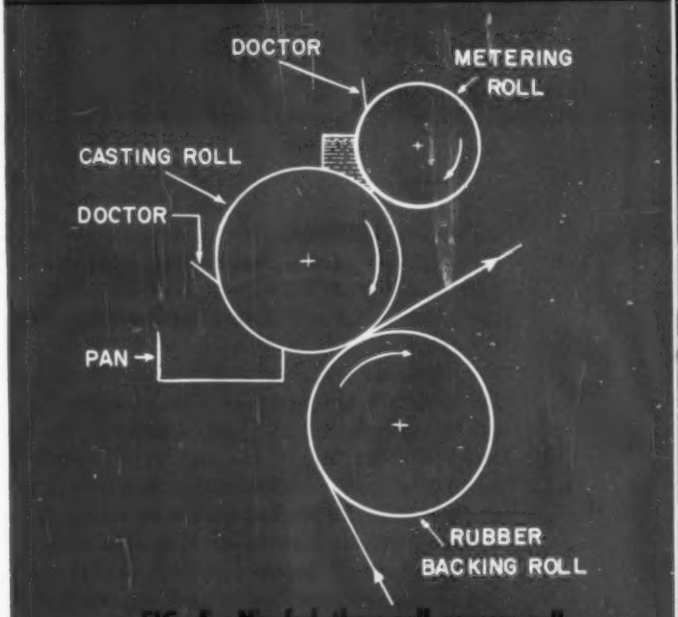


FIG. 5: Nip-fed three-roll reverse-roll

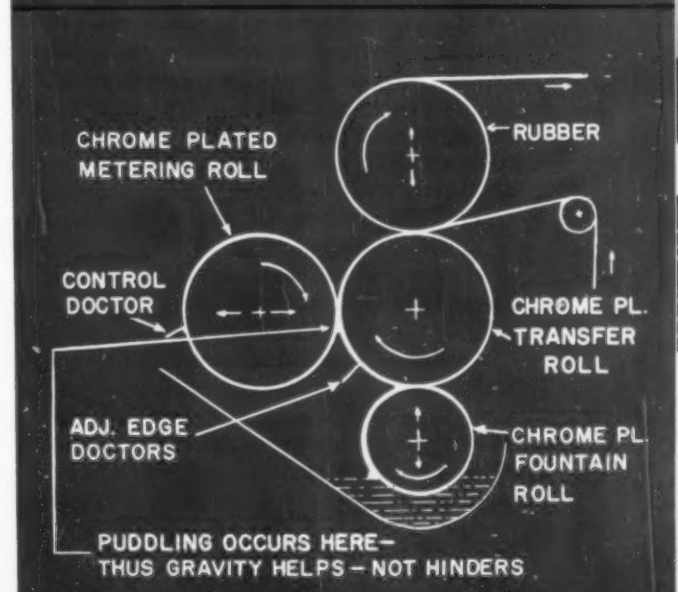


FIG. 6: Pan-fed four-roll reverse-roll

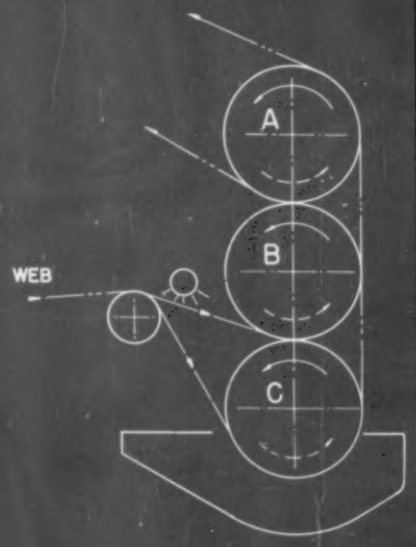


FIG. 7: Two-side nip coater

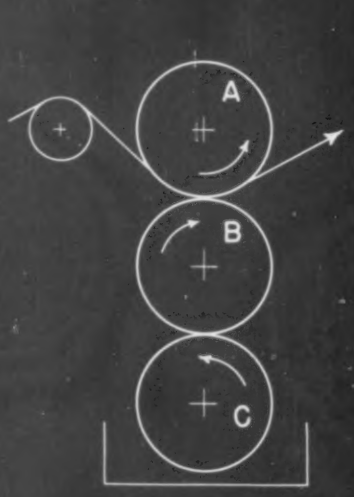


FIG. 8: Three-roll squeeze

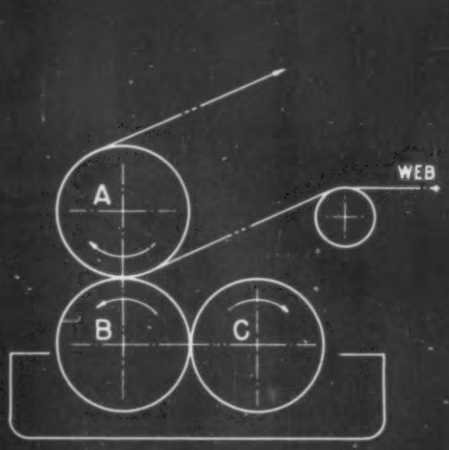


FIG. 9: Modified three-roll squeeze

either vertically or horizontally mounted as in Fig. 3. These rolls can rotate in any combination of directions for kiss application. Normally, the kiss coater is followed by a postmetering or smoothing device.

In another type of kiss coater, three rolls are vertically arranged, with the web kissing off the top roll; an alternate arrangement is to have one roll horizontally mounted and operating against either the bottom or top vertically stacked roll. The advantages and disadvantages of these various systems are much the same.

Nip coaters: Nip coaters, in which the web passes between two rolls, can be classified as two-, three-, and four-roll coaters. Ordinarily, a nip coater is used for application of a fairly thin solution which is not prone to nip patterning. It is perhaps the most common method of coating in use today. The solution is applied to the web using the squeeze principle for both application and metering. The amount of solution applied is dependent upon the following factors:

1) Roll hardness.
2) Nip pressure.
3) The flat area created in the nip, which depends on the loading of the nip and the hardness of the rolls.
4) Viscosity and thixotropy of the solution.
5) Speed of the operation.
6) Characteristics of the base stock such as porosity, bulk, density, and the type of fiber from which it is made.

In some cases a nip coater is followed by smoothing or polishing rolls to develop gloss and level the coating.

Many sizing solutions are applied to paper and fabric with a two- or three-roll squeeze coater. Almost every high-grade paper machine in operation today has a size press on it which is nothing more than a squeeze applicator. However, in such cases, the solution is showered in on the top as well as applied from the bottom so that a simultaneous two-side sizing operation is accomplished (see Fig. 7).

The three-roll method is employed in preference to a two-roll method for closer control of the amount of coating or to handle a more viscous solution through the use of a second nip for premetering or reduction in speed of the fountain roll (see Fig. 8).

Modifications can be made to a three-roll system so that coating can be contained in the nip formed by two bottom rolls, provided one of the rolls is offset (see Fig. 9).

Gravure coaters: Gravure coaters can be broken down into two fundamental groups: direct and offset. In direct application, the coating is transferred immediately from the cells of the gravure cylinder to the web. In offset gravure operation, the gravure cylinder is operated against a rubber-covered roll and the coating is transferred to the web in a nip formed by the top roll and the rubber-covered offset roll. In either case, an additional roll may be employed as a fountain roll to feed the gravure cylinder at higher speeds to prevent splash and agitation of the coating.

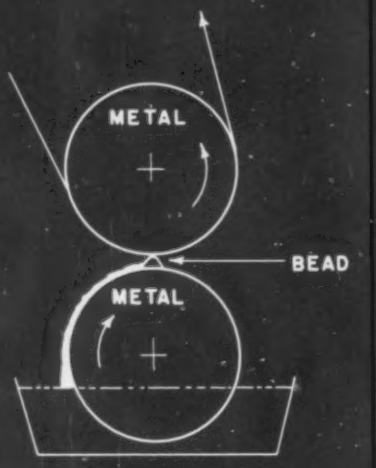


FIG. 10: Two-roll bead

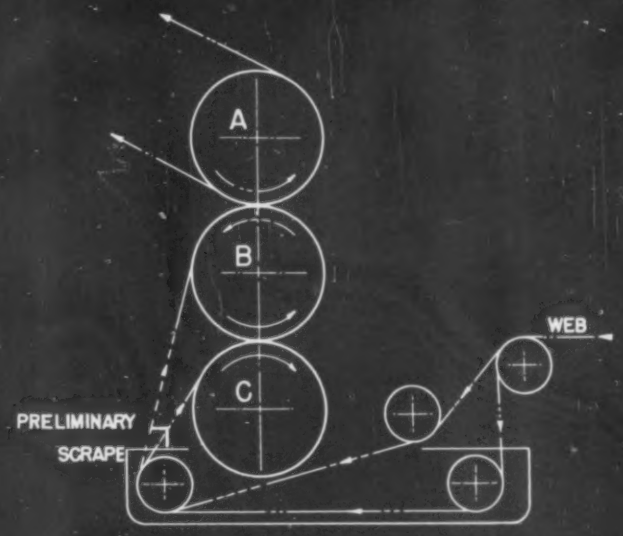


FIG. 11: Dip coater

The biggest advantage of gravure coating is precision of control of coating weight. One limitation is that coating weight cannot be widely varied with a given gravure cylinder. Where large changes are to be made in wet quantity of coating to be applied (per pass), additional cylinders are ordinarily stocked. Lacquers and polyvinyl acetate and PVC adhesives are applied with this type coater.

The author. George L. Booth, author of the accompanying article on coating flexible webs, was born in Binghamton, N. Y., and graduated from the State University of the New York College of Forestry at Syracuse University with a Bachelor of Science degree in pulp and paper manufacture in 1949. He has been employed since that time by The Black-Clawson Co., Inc., manufacturer of paper and plastics converting machinery. For three years Mr. Booth was research engineer in the stock preparation laboratory; for four years he was supervisor of the converting laboratory, Dilts Div.; and since then he has been an application engineer in the sales department of that division.

Mr. Booth has authored a number of papers on coating which have been presented at technical meetings of TAPPI and later published in *TAPPI*, the association's trade journal. He has been instrumental in the development of the four-roll reverse-roll Contracoater.

Bead coaters: The bead or meniscus coater is one of the most accurate of all coaters. Figure 10 shows a typical two-roll bead coater. It consists of two very precise rolls set so that there is a clearance of about 5 mils between the web and the bottom roll. When coating is started, the bead is "struck" or caused to adhere to the web by touching a rod between the bottom roll and the web. Once the bead is formed, coat weight is controlled almost exclusively by speed. Surface tension of the coating material must be kept constant since changes will affect coat weight and surface quality.

Bead coaters are used almost exclusively for application of costly silver halide solutions in the photographic industry. Speeds usually range around 20 ft./min., and coatings a few microns thick are usual.

Dip coaters: Dip coaters are usually used for impregnation and saturation work, as in breadwrap and plies for high-pressure laminates. A typical machine is diagramed in Fig. 11 and a photo of one of the latest installations for saturation work is shown on p. 91.

In most cases the saturant is water thin and may or may not be preheated. The degree of saturation is ordinarily controlled by the character of the web itself, together with metering methods which involve the use of such devices as nip rolls, rods, and knives.

Next month: Concluding discussion of coating methods PLUS a key chart for determining procedures to follow.

Fine future seen for plastisol-coated

Vinyl-metal laminates are widely accepted because of desirable physical properties; new production method cuts costs, opens even broader fields of application

The rapid progress being made by vinyl-metal laminates in applications requiring the rigidity of metal and the color, corrosion resistance, and other desirable qualities of vinyl chloride film has been cited in MODERN PLASTICS, April 1958, p. 102, as well as in earlier issues. Usage of this versatile new material rocketed from approximately one million sq. ft. in 1955 to 18 million sq. ft. in 1957—an increase of 1800% in two years.

There is also another method employed to combine vinyl chloride and sheet metals into a composite material which can be readily fabricated on standard metal working equipment, eliminating the need for subsequent finishing operations. In this method, vinyl plastisol is applied to the metal by reverse roll coating. The plastisol is then oven cured, producing an intimate bond between metal and plastic. Among advantages claimed for this method are a cost saving of 25 to 30%, more rapid production, and improved adhesion between the plastic and the base metal.

A pioneer in the production of vinyl coated metal by this method is Sun Steel Co., Chicago, Ill., whose Texkote line of vinyl-coated steel and aluminum has now been on the market for approximately a year. On its present equipment, Sun Steel can turn out the plastic-coated metal in widths up to 17½ in., at a maximum rate of 30 to 35 lineal ft. per minute. With the completion of new production facilities now under construction, coated sheets up to a maximum of 36 in. wide will be available. As a result, production rates are expected to be stepped up to around 100 ft. of coated stock per minute.

Case for projection screen is fabricated from textured vinyl-coated steel stock on a press brake. "Hemmed" edges, produced by the folding operation, do not cause separation of plastic coating from metal base sheet. (Photo, Radiant Mfg. Co.)

Thickness range available

The Texkote line of plastic coated metal stock is available with a coating thickness from 0.002 to 0.020 in., in a range of solid colors and multi-color effects. An unlimited choice of textures can be engineered into the finished sheets to meet customer requirements, providing the beauty of vinyl plastic in wood grains, leathers, fabrics, etc., with the strength and ductility of steel or aluminum.

Supplied in continuous coils or cut to specified sizes, the plastisol-coated sheets resist chemicals, have excellent color stability (as confirmed by exterior exposure tests in Florida), do not support combustion, and have superior dielectric strength—approximately 750 v./mil of thickness of the vinyl coating. The material, which offers exceptional resistance to scuffing, wear, and abrasion, can be formed, bent, punched, or deep drawn without

metal sheets

Housing for portable TV set, available in pigskin tan and black leather finishes, is produced economically by forming plastisol-coated steel or aluminum sheet stock. Finished case combines scuff resistance, permanent color, and good electrical insulating properties. (Photo, Admiral)

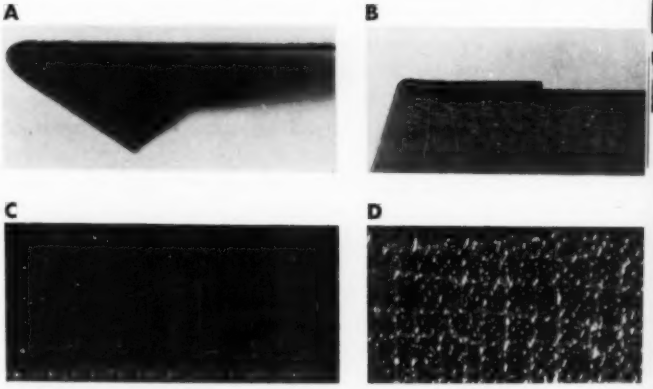
affecting the plastic finish or its adhesion to the metal. An elongation of as much as 30% without appreciable loss of adhesion is possible. The sheets can also be projection welded without damage to the coating.

In fabricating the plastisol-coated metal, standard equipment and methods used in the metal working field are employed.

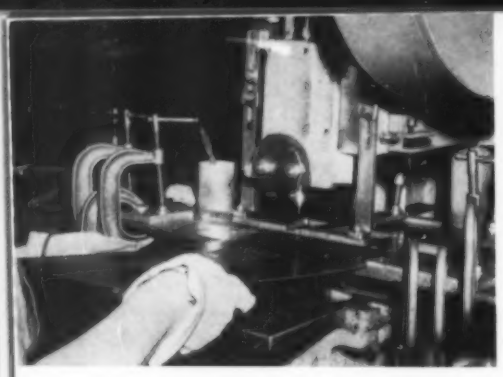
Production method

Essential steps in the production of Texkote sheet stocks are as follows:

The coil of metal to be coated—cold rolled steel, for example—is first carried continuously through processing tanks where it is cleaned, rinsed, and Parkerized for rustproofing. After drying, the metal receives a prime coating which acts as a bonding agent between metal and plastisol. The primer is then baked at over



Excellent adhesion of fused plastisol to steel sheet is demonstrated by bends made during fabrication. Bends are shown in edge views A and B; face of laminates is shown in C and D. The vinyl coating reveals little discoloration or loss of pattern even when bent 180 degrees. (Photos, Heath Co.)



Typical housing for hi-fi equipment (right) is fabricated from vinyl-metal laminate. Two steps in fabrication on standard metalworking machinery are shown above. At left, vents, notches, and mounting holes are punched; at right, punched sheets are formed on press brake, with finished units piled at left of operator. (Photos, Heath Co.)

400° F. for approximately 2 min., giving a dry film thickness of from 1 to 3 mils.

Next comes the application of the specially formulated plastisol, which has a Durometer hardness of from 75 to 95, depending upon the application, and develops a tensile strength of from 1800 to 4000 p.s.i. Applied in a thickness from 2 to 20 mils, controlled to within 0.0005 in., the plastisol coating is then fused at temperatures in the 400° F. range. During the cure, the coating, composed of approximately 95% solids and 5% solvent, converts to 99½% pure plastisol. A reduction in film thickness of approximately 10% takes place during fusion which is completed in 2 min. or less.

While still hot, the coated metal is passed between embossing rolls to produce the desired pattern. The embossing can go as deep as 0.010 in., depending upon the thickness of the coating. Pressure applied during the embossing operation strengthens the bond between metal and plastic and compensates for any minor variations in coating thickness.

Multi-colored effects are obtained by "overprinting" on the cured coating, using vinyl-based inks. This secondary design is then fused by heat, rendering it highly resistant to abrasion or chemical attack.

Applications

Metal wall tile, components for automatic record players, cases for flexible steel tapes and roll-type projection screens, and housings for hi-fi components and portable television sets are among the products being fabricated from the Texkote plastisol-coated metal stocks.

In producing metal wall tile having a linen-finish vinyl coating, Duratile Corp., Mishawaka, Ind., uses 28-gage steel and 0.020-in. aluminum in coils 5¼ in. wide. Fed automatically into a 15-ton stamping press, the material is converted at a rate of 130 stampings per minute into 5-in.-square tiles with a ⅛-in. edge flange. Lubricity of the coating helps speed the forming operation. For the consumer, the vinyl coating provides a durable, easily cleaned surface which cannot corrode.

Heath Co., Benton Harbor, Mich., is currently fabricating the covers or housings for high fidelity components of Texkote steel stock having a black leather-grained plastisol coating with inlaid gold design. According to the manufacturer, the vinyl-coated material not only lends added style and durability, but also provides practical production advantages.

Radiant Manufacturing Corp., Chicago, Ill., has adopted blue leather-grained Texkote steel stock of 22- and 24-gage thickness from which to fabricate the case for its top-of-the-line portable projection screen. Designed with a teardrop cross section and capped with chromium-plated steel ends, the case is formed in a stamping operation on a press brake, starting with the "hemming" of the edges to eliminate raw metal surfaces.

A major manufacturer of (*To page* 202)

Plastics' stake in building

Check list shows where 683 million lb. of plastics are going

Use of plastics in the building field continues to expand. Reasons for this growth include lower installed and maintenance costs, reduced weight, simplification of transportation, ease of installation, greater availability, longer life, and greater design flexibility.

It is estimated that 683 million lb. of plastics materials went into the building industry in 1957. In terms of materials, this figure breaks down as follows:

Phenolics	163
Other thermosets (melamine, urea, epoxy, polyester, polyurethane)	78
Polyvinyl chloride	170
Polystyrene	93
Polyethylene	98
Other thermoplastics (cellulosics, acrylics, saran, etc.)	53
Silicones, synthetic latexes, ion exchange resins	28

In terms of specific applications, the following listing gives you a fairly complete picture of the extent to which the various plastics have penetrated this field. All applications cited are now in actual use.

Foundations

Polyethylene film as vapor barrier underneath concrete slab floor of building.

Polystyrene foam slabs as perimeter insulation; acts as moisture barrier and controls loss of heat from building (see photo above).

Flexible polyvinyl chloride sheet for more complicated types of construction; acts as waterstop in reinforced concrete base and as expansion joint between solid slabs.

Roofs

Glass-reinforced polyester panels, flat or corrugated, for industrial skylights and covering of large open roof areas.

Acrylic domes.

Roof sections of sandwich construction, with reinforced plastics skins and metal or resin-impregnated honeycomb cores.

Styrene foam slabs in joists and between layers of roofing paper for insulation, especially applicable for refrigerated rooms and structures (see photo below right).

Polyvinylidene chloride sheeting for flashing.

Outer walls and structures

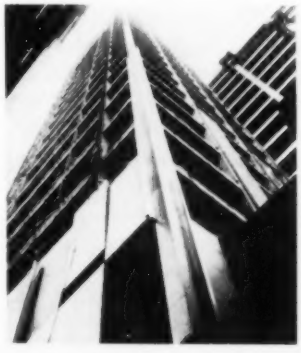
Translucent sandwich panels of reinforced plastics skins on honeycomb-type cores, especially where admission of diffused light is desirable.

Curtain panels of sandwich construction consisting of 1½-in. polystyrene foam cores with 1¾-in. concrete on each side of foam and stainless steel on outer surfaces of concrete. Foam bonds well to concrete, insulates, acts as vapor barrier (see photo below left).

Transparent and translucent panels for glazing made of acrylic, butyrate, light-stable polystyrene, glass-reinforced polyesters, polyvinyl chloride.

Curtain walls of laminated rigid vinyl sheeting, especially where permanence is not the deciding factor.

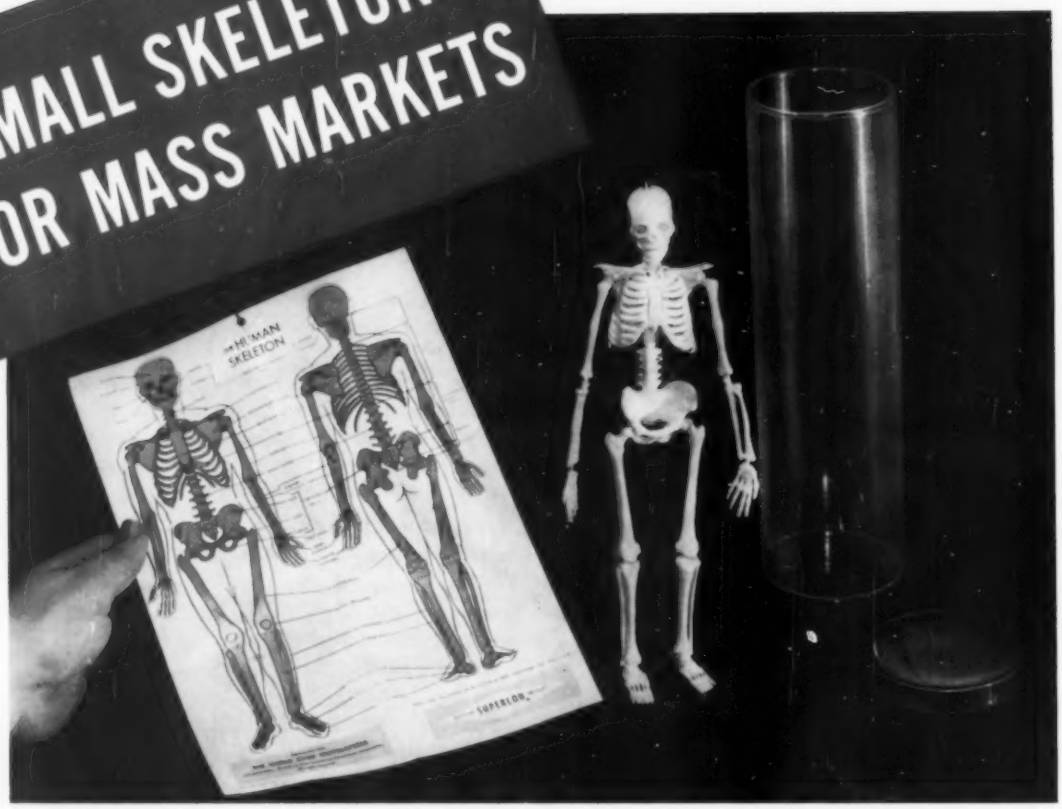
Saran sheet for joining flat to corrugated surfaces along wall lines; acts as waterstop and expansion joint.



Modular cantilevered structures of plastics skin and core sandwich material.

Laminated arches and purlins (*To page* 204)

SMALL SKELETONS FOR MASS MARKETS



One-sixth the size of a 6-ft. man, highly detailed articulated skeleton consists of molded high-density polyethylene components. Model is sold in kit form, ready for assembly, or completely assembled with acetate display tube and cover (at right)

Only plastics could result in a big-market model that could inspire a quote like "We've got quite a skeleton here. He's just as likely to land in the play-box, on a student's desk or in a doctor's office."

Thus did Myron Wersh, sales manager for Plastics Masters, Inc., Chicago, Ill., characterize the broad sales appeal of the anatomically correct 12-in. human skeleton model being molded of high-density polyethylene by Superior Plastics, Inc., Chicago, Ill. Developed as a study aid for medical students, the skeleton has also become one of the "hottest" items to hit the toy and hobby field! It is selling briskly—at $5 completely assembled—through biological and hospital supply houses.

The articulated plastic skeleton, scaled to 1/6 the size of a 6-ft. man, was conceived several years ago by Dr. George C. Young of Des Moines, Iowa. Because actual human skeletons are far beyond the financial range of the average medical student, Dr. Young sought to develop a miniature model which could be produced at reasonable cost. At that time, the smallest plastic skeleton model available—2 ft. high—cost $128.

First came the creation of the original model, hand-made of dental porcelain. Dr. Young showed the prototype to Harry Scheer, president of Superior Plastics, who waxed enthusiastic and began to figure how the skeleton could be duplicated in molded plastic at a reasonable cost. Three years of work and some $25,000 were required for the project.

High-density polyethylene selected

After completion of the intricate tooling necessary to duplicate the 208 bones in the human body, came the problem of material selection. Early tests were plagued by excessive flashing which spoiled the authentic appearance of the molded "bones." However, when high-density polyethylene was tested it was found that it not only eliminated the flashing, but possessed

Low-cost anatomical model, first designed for medical students, has become a big seller in toy and hobby outlets

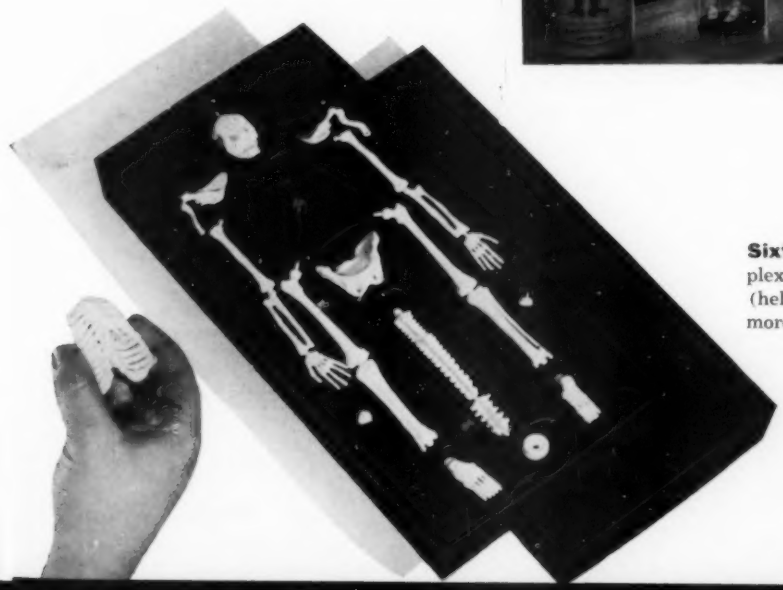
exactly the required physical properties. It combined virtual indestructibility, resistance to temperature extremes, natural bone color, washability, and the right degree of flexibility to permit even the unarticulated parts of the skeleton to be bent into life-like positions.

Articulation of the tiny model was one of the design problems encountered. The porcelain prototype had wired connections; obviously, a simpler and less costly method of joining was required for production. This problem was solved by the adoption of integrally molded snap-joints, about the size of pin heads, which permit the articulated components to be easily snapped together or taken apart. No adhesive is used in putting the skeleton together. All the joints are of the snap-in type except for a few points where soft metal pins are used. If desired by the purchaser, even greater realism can be achieved by separating some of the unarticulated components with a sharp knife or razor, removing the excess material, and drilling tiny holes for connecting wires.

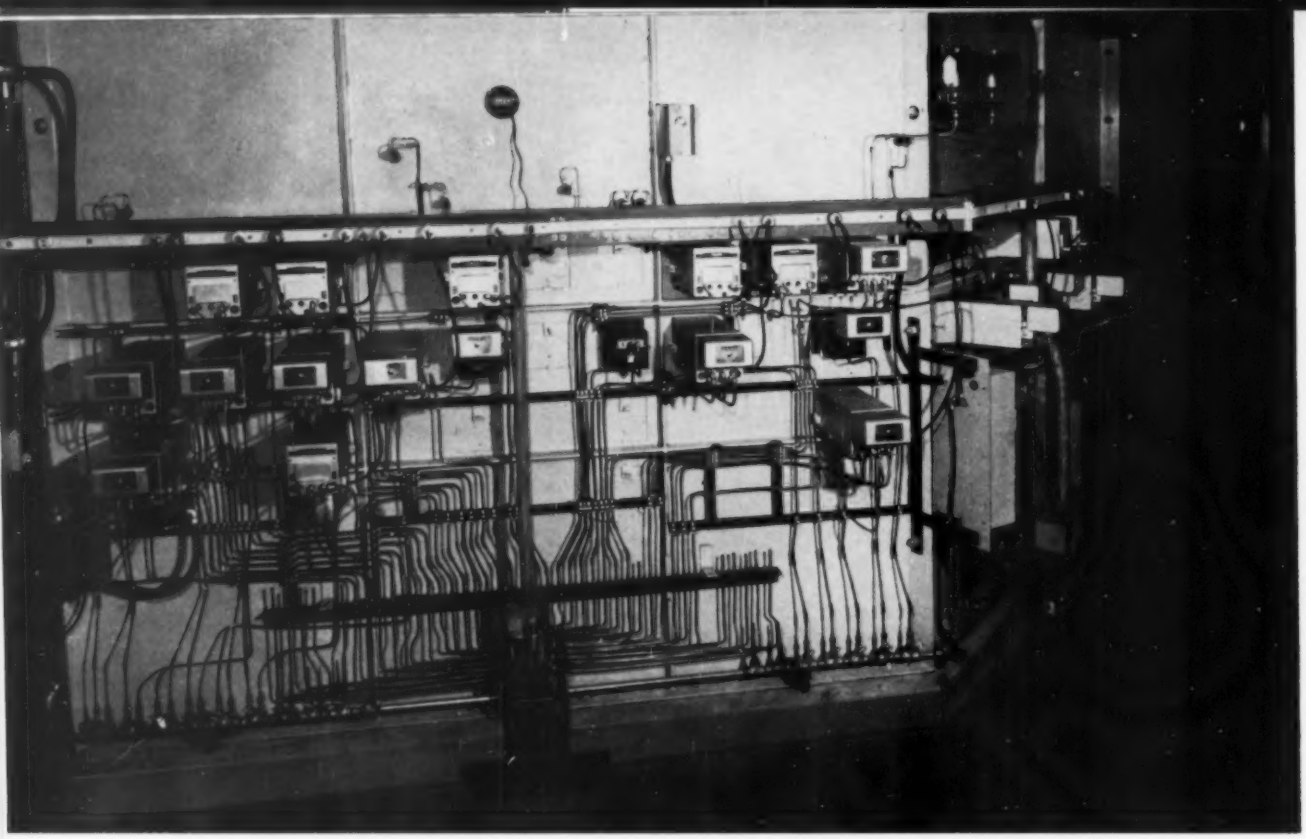
The 16 separate injection molded components in each model are produced in multicavity molds on 8-oz. machines. Molding is carried out in the 380 to 400° F. temperature range. The skull portion, an intricate part involving some relatively heavy sections, is produced in a three-part mold. Finishing involves simply drilling holes for the connecting pins.

The model skeleton is sold as an assembly kit, with or without stand and acetate display tube, at $2 and $3, *(To page 206)*

Fully assembled models being packed in transparent acetate display boxes and corrugated shipping containers. Same line is used for packing unassembled skeletons in boxes



Sixteen molded parts of varying complexity comprise plastic model. Rib cage (held in hand at extreme left) is one of the more intricate components



Nylon replaces copper for tubing used in pneumatically activated measuring and control devices at phthalonitrile plant. The plastic tubing is less expensive, easier to install, and has higher corrosion resistance. Tubing was color coded by inexpensive batch dye process. (Photo, Allied Chemical Corp.)

New jobs for nylon tubing

Low cost and installation advantages give nylon tubing competitive advantages over metal in many pneumatic and lubrication systems

Extruded nylon tubing is taking on many new assignments for which it is uniquely qualified. A number of these applications involve hydraulic or pneumatic systems of various kinds, in which the plastic tubing reduces installation costs, provides built-in corrosion and abrasion resistance, or contributes other advantages not obtainable with metallic tubing. These include ease of cutting, elimination of prebending and deburring, and resistance to vibrational fatigue. The tubing can be easily bent by hand and secured with quickly installed clips. Also, the nylon flares more easily than copper for use with conventional metal fittings, or can be inexpensively solvent-welded.

Automotive air suspension systems may soon develop into a large volume outlet for nylon tubing. And nylon, along with other types of plastics tubing, is being evaluated by car manufacturers as a possible replacement for present metal fuel lines, which require costly prebending and are relatively expensive to install.

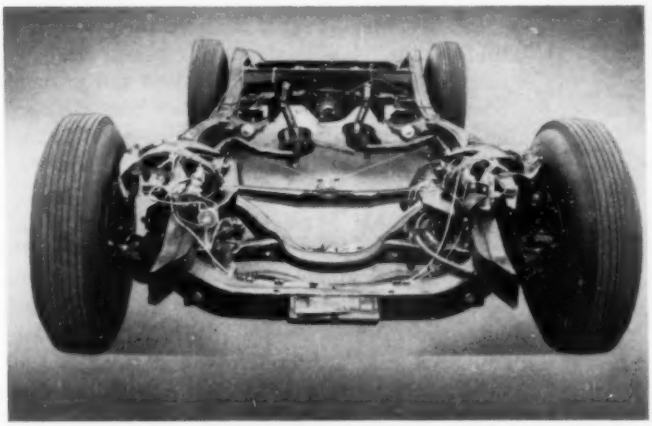
Even the conservative furniture field has felt the impact of nylon tubing. A "self-opening" sofa bed recently placed on the market incorporates a miniature hydraulic system having some 67 ft. of nylon tubing which transmits pressure from the pump to the cylinder which makes opening and closing of the bed a push-button operation.

Developments in the industrial field include color-coded nylon tubing which replaces copper in an instrument-air control panel installed by Allied Chemical Corp. at its Edgewater, N. J., phthalonitrile plant. This is described as the first installation to utilize nylon in the automatic measurement and control of liquid flow, temperature, and pressure. Benefits of the tubing used in this application, the company reports, include a 50% cost reduction per running foot of tubing. In addition, batch dye coding is less costly than pre-molded pigmentation, necessary with other materials.

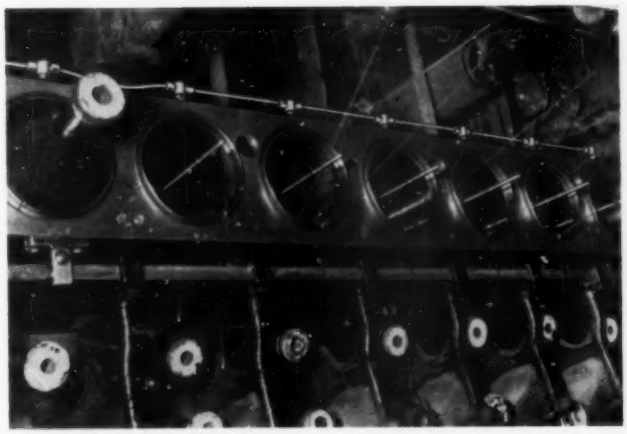
Automotive use

Air suspension systems developed for Lincoln, Continental, Mercury, and Edsel cars by Ford Motor Co. employ varying amounts of nylon tubing specially processed for handling air, gases, or liquids under pressure. In the Lincoln and Continental models, the plastic tubing is used throughout the system except at the exit side of the compressor, where heat runs too high for nylon. In the Mercury and Edsel installations, nylon tubing is used in the control circuit, which activates the fast-leveling valves when the car door is opened, but is not under pressure at all times. Amounts involved range from 65 ft. of tubing in the Lincoln and Continental to 22 ft. in Mercury and Edsel, where copper tubing comprises the balance of the installation.

Tubing used by Ford in these installations is Polypenco Nylaflow, supplied by the Polymer Corp. of Pa., Reading, Pa. Reasons for its adoption, as cited by Ford, are: less expensive

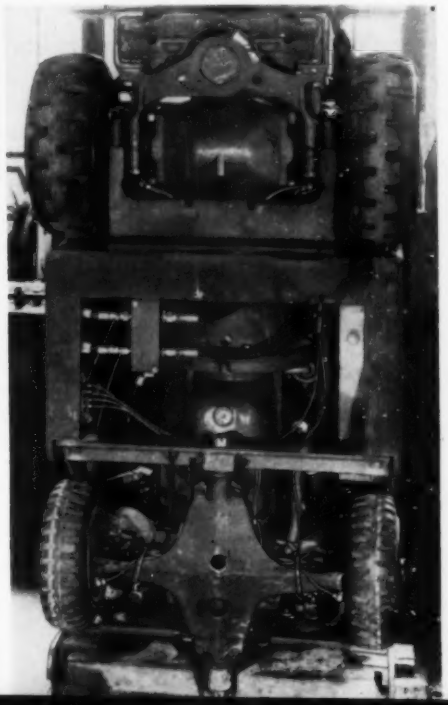


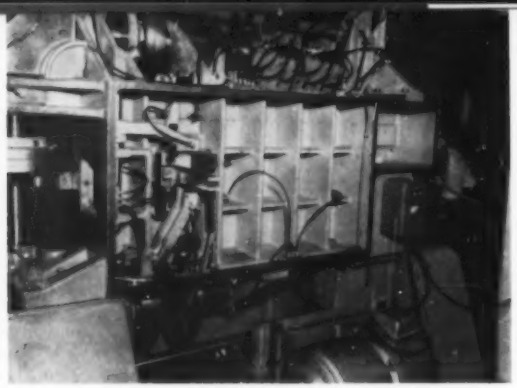
Front view of Edsel chassis (left) shows extensive use of $\frac{3}{16}$-in. nylon tubing in control circuit of air suspension system. Approximately 22 ft. of plastic tubing are involved in this installation. (Photo, Ford Motor Co.)



In large woolen mill installation involving nearly a mile of nylon tubing, centralized system feeds lubrication directly to spinning frame rings through $\frac{1}{8}$-in. line near top of photo. (Photos, Stewart-Warner Corp.)

Inaccessible king pin, clutch shaft, steering mechanism, and other bearings (below) on lift trucks, trailers, and similar vehicles are easily lubricated by centralized system incorporating nylon tubing. Readily installed, tubing also offers exceptional resistance to vibrational fatigue





Fifty-six stationary and reciprocating lubrication points on this metal forming and punching machine are served by a fully automatic centralized lubrication system. Installation makes extensive use of flexible, small-diameter nylon connecting tubes. (Photo, Stewart-Warner Corp.)

than copper or steel tubing; flexible and thus easier to route than metal tubing; non-corrosive; simple to service, using a minimum of tools; permits use of two-piece connectors requiring no forming of ends; and less vibration transmitted to components because of the resiliency of the nylon.

If in future years air suspension systems become generally adopted by car manufacturers and nylon tubing is specified in a sizable share of these installations, fantastic quantities would be involved. Even arbitrarily estimating the amount used per car at 25 ft., installation on one car out of every five produced in a 6 million-car year would require approximately 30 million linear ft. of nylon tubing.

Lubrication systems

Centralized lubrication systems have been used for years, but only recently has plastic tubing found its way into such installations. A pioneering use of nylon tubing in this field was in the Lincoln Engineering Multi-Luber system, which makes possible one-shot lubrication of automotive chassis fittings by pressing a button on the dash panel (MODERN PLASTICS, April, 1956, p. 116).

Now, Stewart-Warner Corp. has announced its new low-cost industrial Alemite "Accumite" centralized lubrication system for use on machine tools; on packaging, canning, labeling, textile, and similar types of machinery; and on vehicles. It is designed for application where numerous bearings require periodic lubrication but limited space will not accommodate a central system. It is being furnished for existing plant installations and also as part of original equipment.

Heart of the system is a miniature metering valve, slightly larger than a lubrication fitting, which services each bearing individually. Four types of pumps available deliver sufficient lubricant to serve from 40 to 200 bearings in one stroke. Where required, systems may be equipped with cycle timers which automatically lubricate the machinery at specified intervals.

The Accumite system is designed to accept nylon, steel, and copper tubing interchangeably. In general, metal tubing is used where a rigid installation is required and nylon tubing recommended where vibration or flexibility is a factor, or where metal tubing would be difficult and costly to install. Use of nylon tubing is limited to parts of the system where pressures are below 2500 p.s.i.; however, even if main line pressures are high, nylon tubing can be used from the valve to the bearing (from which it is separated in some installations) because secondary line pressure is within acceptable limits.

In most installations, the flexibility of nylon tubing eliminates the need for preforming, although the material can be heated and prebent if necessary. Inexpensive snap-on bending clips may also be used to obtain accurate 90° bends. Nylon tubing used in the Accumite installations is Polypenco Nylaflow pressure tubing.

At Portland Woolen Mills, Inc., Portland, Ore., replacement of hand oiling with centralized lubrication cut oil consumption by five-sixths on spinning frame rings; it also doubled ring life and improved yarn quality. Approximately a mile of nylon tubing is used in this Oregon installation.

On a newly designed Torrington metal forming and punching machine, fully automatic lubrication is supplied to 56 stationary and reciprocating lubrication points by means of an Accumite system. Hard-to-reach and multi-motion mechanisms are easily served by flexible, small diameter nylon tubing, eliminating the necessity for flexing hose and other bulky, expensive accessories.

In a semi-automatic system installed as a "do-it-yourself" project on a Mack tractor-trailer involving 46 inaccessible bearings, nylon tubing following the exact contours of the frame carries lubricant to the measuring valves, which snap onto or replace existing grease fittings. Other mobile installations of the Accumite system making effective use of nylon tubing include a 26-point hook-up on a Yale & Towne fork lift truck and a Clark lift truck system serving 17 critical, hard-to-reach bearings.—END

ABS grass catcher

Formed acrylonitrile-butadiene-styrene sheet makes strong and efficient attachment for rotary- and reel-type lawn mowers

Thermoformed container for catching grass clippings attaches and detaches to lawn mower in matter of seconds, has carrying handle and hinged lid. (Photo, U. S. Rubber Co.)

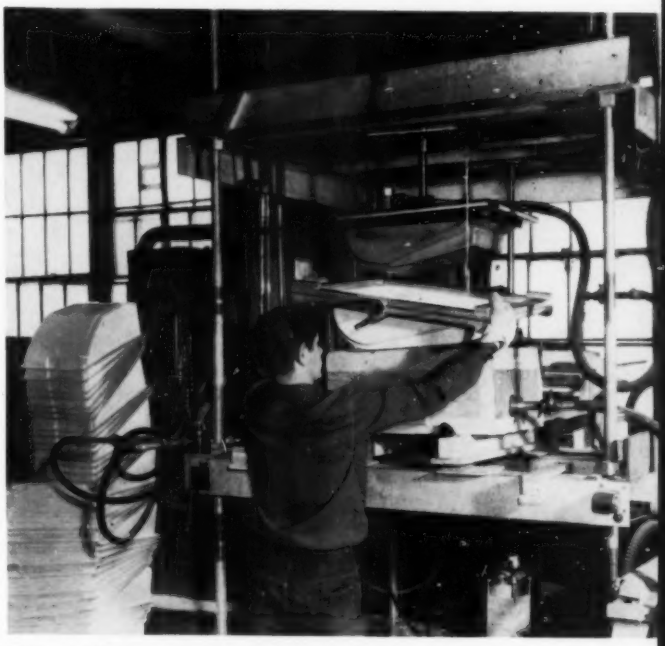
The first grass catcher developed for rotary lawn mowers is based on an intricate thermoforming job. The streamlined container fastens to an ejection chute at the rear of the mower housing, and catches grass clippings propelled by the suction lift rotor. Quickly detachable, the grass catcher has a carrying handle and a cover which prevents clippings from blowing over the lawn.

Because of its formability and impact strength, ABS (acrylonitrile-butadiene-styrene) sheet was chosen for the application. In impact tests, small objects were hurled at the formed plastic sections at speeds up to 200 m.p.h. without ill effects.

The large sections of the grass catcher are formed by the vacuum snap-back technique in which the heated sheet is drawn into a female mold, and then, a fraction of a second later, against a male mold. This technique is necessary to follow the complex contours of the mold, which has radiused corners for strength and smooth-flowing lines, contrasted with sharply indented sides. The depth of the draws reaches 16 in., approaching the difficult one-for-one draw in which the depth equals the width of the sheet being formed.

Vent holes are cut into the upper section of the grass container to release air forced in by the suction lift rotor. A screen is cemented over the vents to prevent grass from escaping. A baffle, which deflects the grass entering the catcher, is cemented into the lower section. The baffle is also made of ABS sheet. The mouth of the grass catcher is strengthened by special pads made of ABS sheet doubled over and reinforced with a steel strap.

The new grass catcher is part of the Turbo-vac Rotary mower manufactured by Jacobsen Manufacturing Co., Racine, Wis. The company, which also makes a formed ABS unit for reel-type mowers, reports that the new grass catchers are being well received by week-end gardeners.



Top section of grass catcher, still held in frame, is removed from sheet forming machine. (Photo, Jacobsen Manufacturing Co.)

Credits: Formed by Kampa Plastics Co., Milwaukee, Wis., from U. S. Rubber's Kralastic ABS sheet extruded by Lus-Trus Corp., Ypsilanti, Mich.

Latest In Liners

Economy of shipping "problem" materials is gained through use of fabricated and molded plastics liners

Vinyl-rubber copolymer film liner is tailored to fit snugly inside any container; will accept pourings at 300° F. and remain flexible down to −20° F. (Photo, R. L. Kuss & Co.)

Lightweight carboy for shipment of corrosive acids, consisting of blow-molded polyethylene bottle and steel outer jacket, costs and weighs less than equivalent glass carboy. (Photo, Jones & Laughlin Steel Corp.)

Bulk shipment of foods, acids, and other corrosive chemicals is being simplified and made more economical with the recent introduction of several interesting liner-shipper combinations.

Involved are vinyl, polyethylene, and phenolic on one hand, and steel drums and corrugated cartons on the other.

Vinyl liner fits any container

Now being offered by R. L. Kuss & Co., Findlay, Ohio, is a vinyl-Buna-rubber copolymer film tailored to customer specifications to fit snugly any size and shape of container. The film can be heat-sealed or electronically welded. The tailoring is said to eliminate wrinkles, voids, pockets, and folds—disadvantages associated with liners not tailored to shape. The film is intended for food packaging, particu-

larly for fats, oils, shortenings, essential oils, and similar products.

Properties claimed for the new liner include impermeability to carbon dioxide, oxygen, hydrogen sulfide, and odors; tensile strength of 2200 p.s.i.; elongation of 200%; capability of receiving hot pourings up to 300° F.; and flexibility down to —20° F. The heat resistance of the material permits packaging of various fats in liquid form, letting them solidify in the container.

Polyethylene carboy in steel drum

A returnable container for shipping corrosive chemicals consists of a blow-molded polyethylene inner carboy and a steel drum outer jacket. Designated JALboy, it is being produced and marketed jointly by Container Div. of Jones & Laughlin Steel Corp., Pittsburgh, Pa., and Plax Corp., Hartford, Conn. Two sizes are offered: standard 14 gal., with 5¾-lb. inner container; and heavy-duty 13-gal., with 8¾-lb. inner container.

The exterior of the steel container is coated with a phenolic-based material to resist corrosive atmospheres and spillage. The cover can be obtained coated with 8 to 12 mils of PVC as protection against spillage corrosion.

Several advantages are claimed for the product. Foremost is price. The 14-gal. JALboy, for example, retails at $9.96. Cost for an equivalent glass carboy is $12.50. Other benefits include lower tare weight and less cubage, with consequent savings in freight and handling costs (the JALboy is only ⅛ the weight of a glass carboy); increased safety because of elimination of breakage; and extended service life.

Polyethylene bottle in corrugated box

Dry charge batteries demand economical and easily-handled shipping containers for the acid electrolyte. The problem has been solved by Firestone Tire & Rubber Co., Akron, Ohio, through the use of a blow-molded polyethylene bottle (Plax Corp.) within a corrugated box designed by Hinde & Dauch, a division of the West Virginia Pulp and Paper Co., Sandusky, Ohio.

The 5-gal. polyethylene bottle is put into the double-wall corrugated box as soon as the bottle is produced. The units are then shipped to "bottling" points where the bottles are filled with electrolyte without removing them from the box, closed with polyethylene screw caps and shipped to retail outlets. The dealer substitutes a dispensing tube for the screw cap, inverts the bottle (still in the box), places it on a rack, and is ready to fill batteries. Electrolyte is dispensed by gravity.

Bottle and box combined weigh about 3 lb., compared with approximately 30 lb. for the glass bottle and wooden crate traditionally used for battery acid. The box is 20 in. high by 11 in. wide and deep; filled, it weighs less than 50 lb., and can be easily handled by one man. The box has also merchandising value because of the colorful company identification imprinted on its side.—END

Combination of polyethylene and corrugated box brings economy and convenience to battery acid shipments. Bottle need not be removed from carton at "bottling plant" in order to be filled with electrolyte

Inverting entire package makes it ready for dispensing. Electrolyte flows to battery by gravity. (Photos, Hinde & Dauch)

PHOTOCOPIER

Replacing stainless steel, molded plastics parts are lower in cost and weight, afford greater latitude in design, and have molded-in color

A four-to-one cost advantage over stainless steel, and a comparable reduction in weight, were two of the major factors which prompted American Photocopy Equipment Co., Evanston, Ill., to specify a molded melamine housing for its latest Apeco Uni-Matic Auto-Stat copying machine. Retailing at $423.50 and completely automatic in operation, the Uni-Matic is the top model copier in the Apeco line.

Apeco has also announced that a molded melamine housing will be used on its "Ply-On" laminator, a revolutionary desk-type office machine that protects, preserves, and beautifies important business papers, price lists, etc., by permanently laminating to one or both sides a layer of transparent Mylar or other heat-sealable plastic film. In addition, Apeco plans to market a new low-priced photo-copying machine, having a plastic housing, within the next few months.

This swing to molded plastic housings by one of the nation's leading producers of office type photocopying equipment is significant because all its housings in the past have been fabricated of stainless steel. The company points out that as the photocopy industry grew increasingly competitive, it became necessary to effect production economies whenever possible. Estimates by the company are that use of a stainless steel housing on the Uni-Matic would have boosted the retail price of the machine approximately $100.

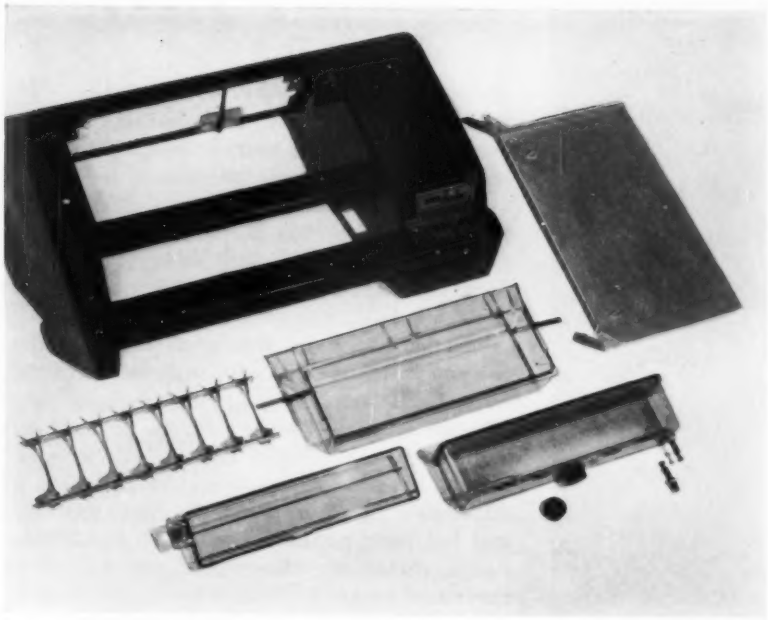
More than cost and weight

Although the cost and weight angles were important to Apeco and to Charles E. Jones & Assocs., Chicago, Ill., who styled these two new machines, they do not tell the entire story. The melamine housings also afforded greater latitude of design and molded-in color which eliminates the need for subsequent finishing operations. At present, the copier housing is being molded in a combination of dark and light gray on the two components. The use of melamine makes a variety of colors available, should Apeco decide to use them.

Pleasingly styled to harmo- (*To page* 208)

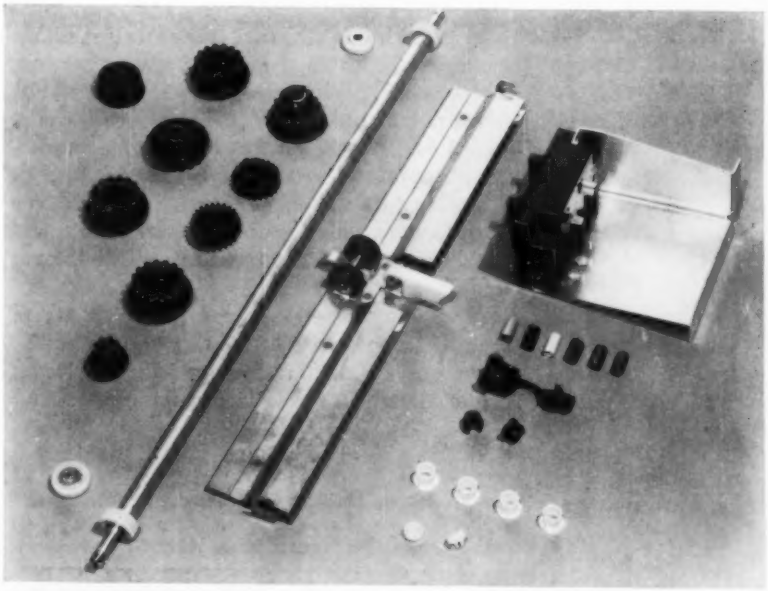
Plastics components in office photocopier unit

Name of part	*Material used*	*Function of part*	*Advantages*
Housing and cover	**Melamine**	Encloses working parts. Determines exterior styling and over-all appearance of unit	4-to-1 cost and weight advantage over stainless steel housing. Integral color. Reduced finishing operations. Greater design latitude
Replenishing tank	**ABS resin**	Keeps processor tank filled with developing solution.	Economy, light weight, resistance to breakage, immunity to processing chemicals. Transparency of replenishing tank affords visual check of contents
Processor tank	**ABS resin**	Contains developing solution	
Processor tank trough	**ABS resin**	Forms removable compartment for processor tank	
Miscellaneous gears, pulleys, bearings, and bearing inserts	**Nylon**	Control movement of paper through copier. Act as bearings for various shafts in working assembly	Quieter and less costly than equivalent metal parts. Require no lubrication
Separators and rollers in separator assembly	**Nylon**	Guide original, negative, and copy through machine, automatically separating them for processing	Smooth, quiet operation. Need no lubrication which might smear paper. Separator, molded to unusual shape and critical dimensions, requires no finishing
Switch terminal block and push buttons	**Phenolic**	Control operations of unit	Good impact strength, dimensional stability, and electrical insulating properties



Housing and cover (top row) are molded of melamine. Transparent ABS parts shown include processor tank, tank trough, and replenishing tank (lower right) with phenolic cap and valve with vinyl gasket

SWINGS TO PLASTICS



Molded nylon gears (black parts, left) control movement of paper through the photocopying machine. Also of nylon are bearings used on cylinder retaining shaft, rollers and white cam used in separator assembly (center), strain relief clips for electric cord, bearing inserts, and plug buttons. Other plastics parts include phenolic switch block and push buttons and vinyl tubing sleeves for electrical terminals. Complete unit is below

New premix reinforced plastics cabinet for Sears Roebuck portable TV set completely encloses the receiver; set weighs only 30 pounds

Better cabinets for TV portables

Reinforced plastics, either as premix or preformed, are standing up to all tests. Main factors are light weight, safety, strength, and design latitude

Latest contender in the television cabinet field is compression molded reinforced polyester premix—a relative newcomer in plastics molding compounds. This material made its appearance in the 1958 Silvertone Suburbanite 17-in. portable television set produced for Sears Roebuck & Co. by Warwick Manufacturing Corp., Niles, Ill.

Thanks in part to the light weight of the cabinet, which is molded in three sections, the Suburbanite is really portable, weighing only 30 pounds. Attractively styled, the compact set features a safer, fully enclosed back, convenient controls mounted on the side, and a telescoping dipole antenna. To date, the cabinet has been produced with a charcoal base and a choice of yellow, coral, or turquoise cover and back.

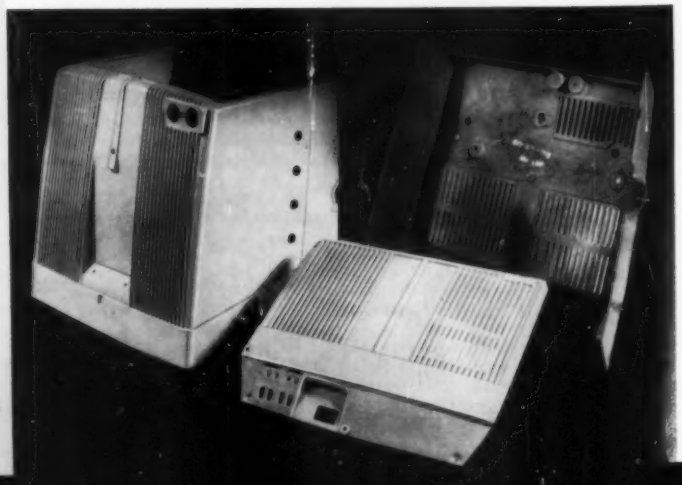
Other features of the reinforced premix cabinet are its sturdiness, resistance to scratches and stains, and the fact that it is electrically non-conductive—an important safety factor with portable TV sets.

Why premix was selected

In considering the materials and methods which could be used to produce the cabinet, comparative costs played an important—but not a dominant—role. Since this set was projected as a "high end" rather than a promotional model to be sold mainly on price appeal, due allowance was made for such other factors as design latitude, weight, integral color, electrical insulating characteristics, and quality of sound reproduction.

After study of all materials available at the time the cabinet was in the design engineering stage, premix molding compound was selected as the one which would yield a finished cabinet

Cover, back, and base of cabinet (left to right) have louvers to reduce weight of cabinet while providing outlets for sound and heat



with adequate impact characteristics and would permit greatest latitude of design plus unlimited coring directly in the mold.

In addition, comparisons showed that the premix-molded cabinet would be somewhat less costly than a vinyl clad aluminum cabinet, somewhat heavier than the aluminum cabinet or preform-molded polyester (but not prohibitively so), and lower in weight and slightly more costly than a vinyl-steel cabinet. Sound reproduction, it is reported, was better than in a metal cabinet.

Light but strong

Total weight of the three reinforced plastics for the cabinet is just over 7½ lb., distributed as follows: cover, 3¾ lb.; base, 2½ lb.; and back, 1⅓ pounds. All three parts incorporate ribbed louvers which contribute to the styling of the cabinet, provide multiple sound outlets for the speaker, and dissipate heat from the set.

The material used in producing the cabinet parts is described by the molder, General American Transportation Corp., as a high glass content premix compound composed of glass fibers, polyester resin, fillers, and a small percentage of sisal fibers. It was developed by the molder's Research and Development Dept. and is compounded in the plant.

By having complete control over the formulations, the molder is able to take full advantage of fast-acting compression presses, keeping the cycle as rapid as possible. The components are produced at a rate in excess of 60 parts per hour from any single cavity. Compression presses ranging in capacity from 50 to 200 tons are used.

The assembled premix cabinet passed all Underwriters' tests with flying colors. These included the conventional dropping ball test and an entirely new UL test procedure, specifically aimed at testing the strength of the louvered areas in the bottom of the assembly. In this latter test, the assembled TV set is placed on top of a metal ball about 3 in. in diameter, and weight is added until total weight of the assembly is 40 pounds. The test requires that the louvered section withstand this pressure without breakage.

Molded in one piece, cabinet for Porta-Bell TV receiver is produced by preform molding method. (Photo, Minnesota Mining)

Front view of cabinet shows how parts are joined by assembly screws. Integrally molded ribs anchor picture tube support

Preform molded cabinet

Also molded of glass-reinforced plastic—but by the preform method rather than of premix compound—is the cabinet for a 1958 portable TV set produced by Packard-Bell Electronics Corp., Los Angeles, Calif. Available in three colors—charcoal, mocha, and turquoise, each with white trim—the Porta-Bell cabinet is molded in one piece by Zenith Plastics Div., Minnesota Mining & Manufacturing Co., Gardena, Calif.—END

PLASTICS PRODUCTS

Unsinkable boat

A new lightweight, low-cost and completely unsinkable small boat, 5 ft. long and 2 ft., 8 in. wide, is molded of polystyrene foam in one solid piece. The Z-boat weighs only 15 lb.; completely filled with water and submerged to the waterline, it will still support a 250 lb. person in the boat, or as many people in the water as can hang on to it. Unlike an inflated raft, there can be no punctures or valve leakage. The foam material will not absorb water and is not affected by extremes of temperature, sun, or prolonged exposure. The boat can be propelled either with hands or a paddle and, because of its light weight, it makes an ideal safety raft or versatile dinghy for camping or boating trips. Retail price is $39.95.

Credits: Manufactured by the Jay V. Zimmerman Co., 7933 Clayton Rd., St. Louis, Mo., of Koppers' Dylite expandable polystyrene.

Outdoor thermometer

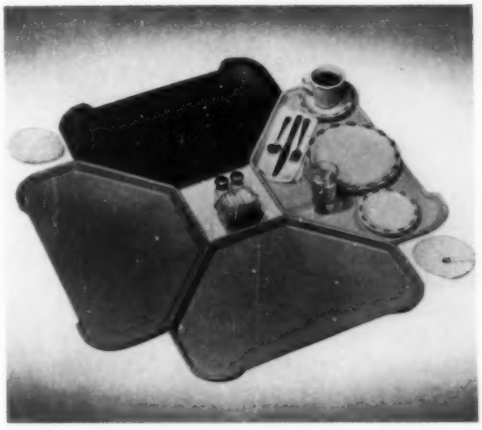
Acrylic-housed, a new disk-shaped outdoor thermometer that attaches to a window pane by means of a hard-setting waterproof adhesive is 4½ in. in diameter and has ¼-in.-high calibration numerals that permit reading the temperature across an average room.

The two part housing, which encloses the coil element and pointer, is injection molded on an 8-oz. automatic Fellows machine. Calibrations are hot stamped in bright yellow and have high visibility even in low incident light.

Acrylic was selected for this application because of its excellent weathering properties, its crystal clear transparency, moldability, and break resistance.

The item retails for $1, including the adhesive. National distribution is through department, hardware, and houseware stores; supermarkets; rack jobbers; etc.

Credits: See Thru Outdoor Thermometer made by Springfield Instrument Co., Inc., 163 Clay St., Hackensack, N. J.; molding by Anderson Tool & Die Corp., 430-89th St., Brooklyn, N. Y.; Lucite acrylic by Du Pont.



Improved food tray

Cafeteria service and customer turnover are speeded up with a new line of cleverly designed molded reinforced plastics food trays. Aim of the new design is to encourage users to keep dishes on trays while eating. This is accomplished in two ways: 1) The lip of the tray along the side facing the patron is flattened to give him a comfortable place to rest his forearms while eating. Raised lips of ordinary cafeteria trays cut into forearms and produce a certain degree of discomfort. 2) Instead of the usual rectangular shape, the trays are made in an irregularly hexagonal configuration so that four of them fit on a 1-yd.-sq. table. Space for condiments is left in the center.

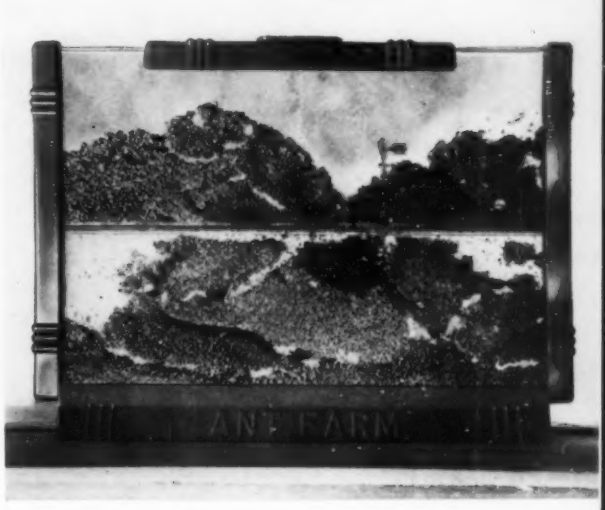
Available in red, yellow, green, and gray, the trays measure 22⅛ in. long by 14 in. deep. The trays will not warp, bend, or rot, and their smooth surfaces and rounded corners make cleaning easy.

Credit: Produced by Molded Fiber Glass Tray Co., Linesville, Pa.

Ant farm

All the activities of a busy ant colony can be observed through the transparent walls of a new, all-styrene "ant farm." The "farm" measures 6 by 9 in., and consists of two face plates of clear styrene molded with edge lips to form an enclosure about ¼ in. deep. These plates are held together by bright green injection-molded side pieces. Clip-on molded pieces form the top and bottom, the latter flanged to serve as a base on which the ant farm stands. When the farm is put together, the bottom is removed so that earth can be inserted under the molded styrene farm scene fastened between the two face plates. The top strip, removable for introduction of ants, food, and water, is provided with a series of holes for ventilation. The ant farm retails for about $3. Each kit includes an "ant watchers manual" and a certificate to be mailed to the manufacturer for a free supply of red harvester ants.

Credits: Molded by Fischer Plastics Co., Burbank, Calif., for E. Joseph Cossman & Co., 7015 Sunset Blvd., Hollywood, Calif., of Monsanto Lustrex styrene.



PLASTICS PRODUCTS

Car cover

Vacuum metallized low-density polyethylene film, 4 mils thick, makes a convenient car-cover for year-round use. The cover is fabricated from two sheets of film joined by a stitched seam the full length of the top of the car. Edges are hemmed and laced with an elastic band that extends at both ends and stretches over the bumpers for fastening. The sewed hems are reinforced with ¾-in. adhesive tape.

The film is lightweight, flexible, and waterproof and is claimed to keep the interior of a car parked in the sun at about 85° F. Distribution to consumers is through automobile seat cover manufacturers, to whom the material is sold by the yard. Price is $1.25 per lineal yard, 54½ in. wide, including elastic band and adhesive tape.

Credits: Manufactured by Hewitt Wells Co., 1401 K Street, N. W., Washington 5, D. C.; aluminized low-density polyethylene film by Continental Can Co., Mt. Vernon, Ohio.

RP wastebasket

Rugged strength, rigidity that eliminates distortion, and complete imperviousness to rust are features of a new reinforced plastics wastebasket. Made of polyester resin and fibrous glass, the basket gains stability from four inconspicuous feet molded into the base. The pattern made by the glass reinforcement gives a distinctive attractiveness and minimizes scratch and scuff marks. A vinyl trim strip surrounding the top rolled edge of the basket prevents smudges on walls, scuff marks on walls, or snags in nylon hosiery. The basket is molded in several colors with matching vinyl trim.

Credits: Manufactured by Armored Plastics Co., Lint and Dura Aves., Toledo, Ohio, of Plaskon polyester resin from Allied Chemical Corp.; glass reinforcement by Owens-Corning Fiberglas Corp.; and colors from Ferro Corp.

Snap-on insulation

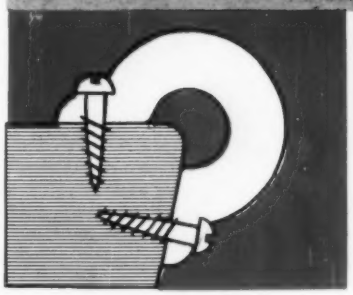
Thermal insulation with a low K-factor and excellent resistance to physical damage and to chemicals and solvents is now being made in snap-on form from flexible urethane foam. The insulation is designed for service between — 200 and + 250° F., and is said to be ideal for all refrigeration work and low-pressure (5 p.s.i.g) steam lines. Other advantages of urethane foam insulation are that it does not fray, crumble, or break in handling or disintegrate even when soaked in water. It will not rot or decay, and is vermin-proof. Because the foam is chemically stable, it will not cause corrosion in metals. Its light weight of 3 lb./cu. ft. means that little weight is added to the pipe line. Unlike rigid insulations, the foam insulation requires only one seam. It readily deforms to be slipped over pipes and fittings, then snaps back to its original shape.

Credits: Manufactured by Rainbow Industries, Inc., Butler, Pa., with Nacconate diisocyanates supplied by the National Aniline Div. of Allied Chemical Corp.

Vinyl boat guard

A permanent guard for protecting boat gunwales from damage is based on a heavy vinyl extrusion marketed under the name Vinyl Guard. Manufactured in gleaming white, Vinyl Guard has an inner air pocket (see drawing) that acts as a built-in shock absorber. It is not affected by salt water, sun, or weather and can be used to protect any type of boat—reinforced plastics, wood, or aluminum. The extrusion, supplied in one continuous length, is held in place by means of a specially formulated adhesive supplied by the manufacturer. For additional security, round-head brass screws or self-tapping aluminum screws may be used at stress points and to fasten down the ends.

Credit: Extruded by Jessall Plastics, Inc., 889 Farmington Ave., Kensington, Conn.



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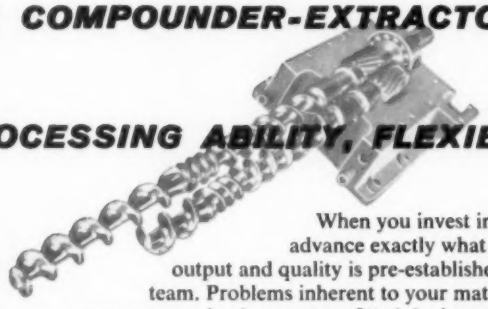

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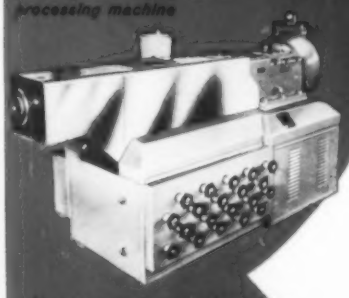
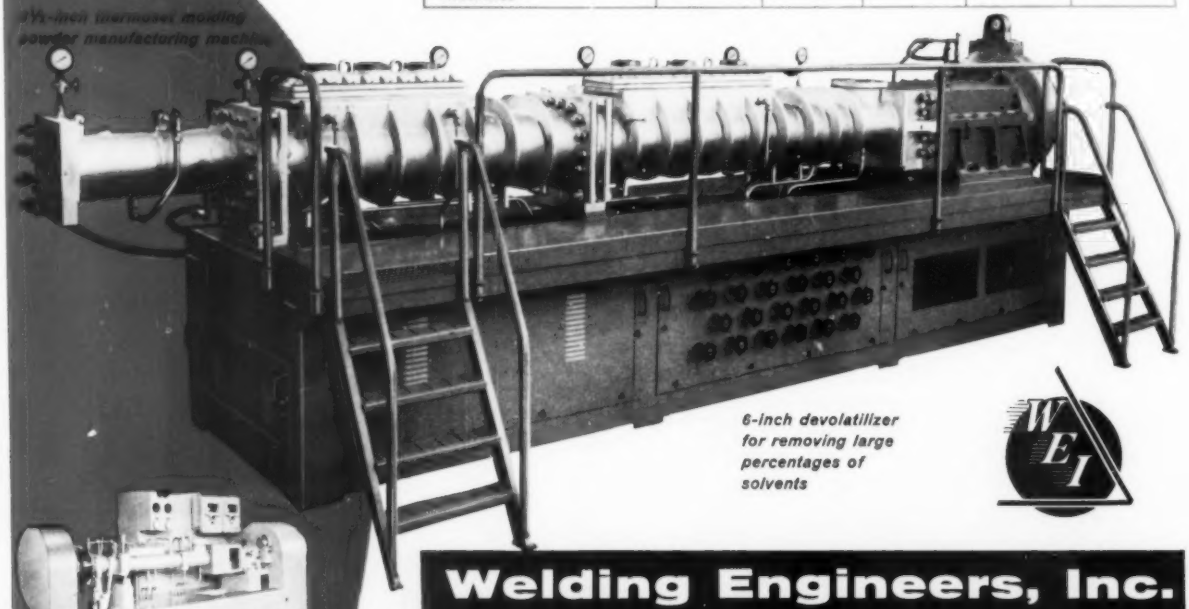
Typical 4½-inch low pressure polyethylene or polystyrene processing machine



4½-inch thermoset molding powder manufacturing machine



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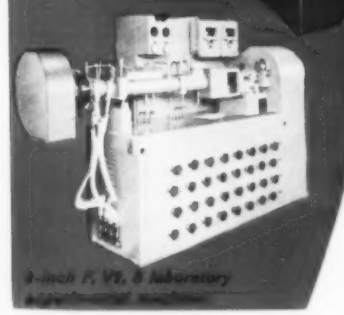

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Valve gating of injection molds

By Albert Spaak† and George Kelly‡

Valve-gated molds are hot-runner molds in which the conventional gates have been replaced with quick-opening valves. The use of the valves makes it possible to alter slightly the sequence of machine operations so as to precompress the melt in the cylinder and runners while the mold is open. When the valves are snapped open, the rapid decompression provides an extra-fast initial flow into the mold. Thus, valve-gating results in shorter cycles, particularly with pieces requiring long flows or having thin sections. Other advantages include: lower piece weights, more uniform dimensions, reduction of molded-in stresses, milder molding conditions, increased shooting capacity, and less down time and maintenance.

During recent years there has been increasing emphasis in injection molding on improving both the economy of the operation and the quality of the products. It was recognized some years ago that both these factors could be improved by increasing the injection rate, particularly when molding large thin sections.

The importance of filling all the cavities in a multi-cavity mold simultaneously was explained in detail in "Runner and gate design," M.PL., Oct. 1956, p. 166). Hot-runner and runnerless molding were invented to eliminate the trouble, expense, and risk of contamination entailed in recovering sprues and runners. Weigh feeders were introduced to improve the uniformity of product made in successive shots, and to economize on material. H. Schwartz showed that preplasticators can be used to increase output and quality even on relatively small shots (M.PL., Nov. 1956, p. 143).

A new development, valve gating,[1] is a step forward along all these lines. It offers increased control of product quality and uniformity as well as economy of material and labor.

Pre-compression does the trick

In valve-gated molds, the conventional gates are replaced with automatically operated quick-opening valves. Heated runners are used and the valves are kept closed until the ram has advanced part way and compressed the melt to the full injection pressure. Suddenly the valves are opened and the compressed melt spurts into the cavities at rates considerably higher than could be obtained by the normal procedure at the same pressure. The sequence of operations is shown schematically in the diagrams of Fig. 1, p. 118. When the cavities are full, the valves are closed and the injection ram can then be retracted to pick up the next shot *while the piece is cooling in the mold.* Then the piston moves forward, compressing the material in the cylinder and runners *while the mold is opening.* Thus, much of the ram motion occurs concurrently with other operations, so the overall cycle is shortened not only by having faster filling, but also by the saving of ram-in-motion time. Both these factors can be large when thin sections are being molded. It appears now that valve gating is most valuable for molding thin sections and for thicker sections where exceptionally long flow is required.

The expansion of the melt when the valves open is extremely rapid. While the amount of flow this expansion yields will depend on many factors, some notion of its importance can be gained from a simple calculation for typical conditions. Suppose that low-density polyethylene is being molded at 400° F. and 15,000 p.s.i., and that the cavity volumes add up to one-third of the volume

* Reg. U. S. Pat. Off.

† Applied Arts Supervisor, Polymer Chemicals Div., W. R. Grace & Co., Clifton, N. J.
‡ General Supt., Columbus Plastic Products, Inc., Columbus, Ohio

[1] Valve gating of molds is the subject of U. S. Patent Nos. 2,770,011 and 2,773,284, held by Columbus Plastic Products; the technique was later developed independently in the laboratory of W. R. Grace & Co.

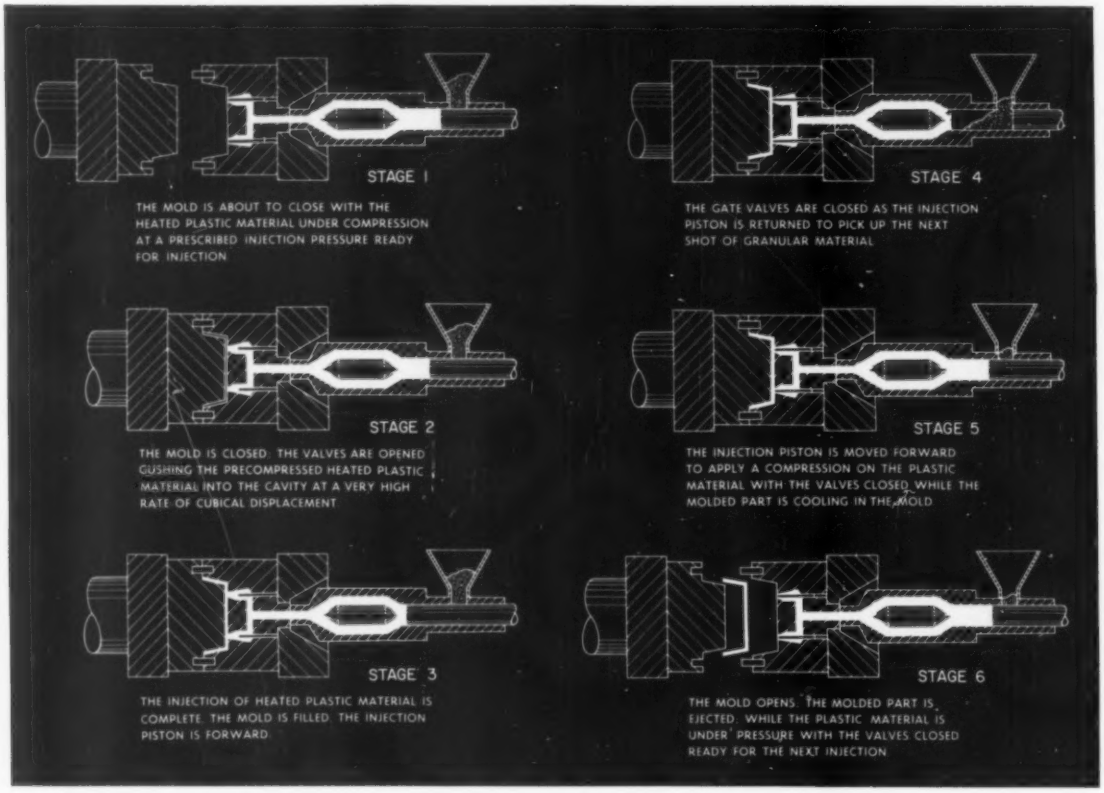

STAGE 1
THE MOLD IS ABOUT TO CLOSE WITH THE HEATED PLASTIC MATERIAL UNDER COMPRESSION AT A PRESCRIBED INJECTION PRESSURE READY FOR INJECTION
STAGE 2
THE MOLD IS CLOSED. THE VALVES ARE OPENED GUSHING THE PRECOMPRESSED HEATED PLASTIC MATERIAL INTO THE CAVITY AT A VERY HIGH RATE OF CUBICAL DISPLACEMENT
STAGE 3
THE INJECTION OF HEATED PLASTIC MATERIAL IS COMPLETE. THE MOLD IS FILLED. THE INJECTION PISTON IS FORWARD.
STAGE 4
THE GATE VALVES ARE CLOSED AS THE INJECTION PISTON IS RETURNED TO PICK UP THE NEXT SHOT OF GRANULAR MATERIAL
STAGE 5
THE INJECTION PISTON IS MOVED FORWARD TO APPLY A COMPRESSION ON THE PLASTIC MATERIAL WITH THE VALVES CLOSED WHILE THE MOLDED PART IS COOLING IN THE MOLD
STAGE 6
THE MOLD OPENS. THE MOLDED PART IS EJECTED. WHILE THE PLASTIC MATERIAL IS UNDER PRESSURE WITH THE VALVES CLOSED READY FOR THE NEXT INJECTION

Fig. 1: Sequence of machine operations in pre-compressed molding with valve-gated molds. Doubling-up of some of ram motion with mold-open time shortens over-all cycle

of melted or partly softened material compressed in the cylinder and runners before the valves are opened. Using the equation of state of Spencer and Gilmore (*Journal of Applied Physics*, June 1950, p. 523) and their constants for polyethylene, the percentage increase in volume as the pressure drops to zero from 15,000 p.s.i. is about 8.5 percent. Since the compressed volume is three times the cavity volume, over 25% of the filling would be accomplished by decompression alone.

Figure 2, p. 119, is a cutaway view of the female half of a two-cavity, valve-gated mold, and is self-explanatory. Note that the stroke of the valve pin is long enough so that, when opened, the valve offers little resistance to flow of melt into the cavity.

It is possible to have valves in single- and multi-cavity molds, with more than one valve per cavity, where that is desirable. In some molds, a single actuator operates several valves. Where more than one valve is used, some care must be taken in laying out and assembling the actuating air or hydraulic system so as to have all the valves act in concert. The mechanism can be incorporated into many existing molds after careful analysis of the mold's construction.

Pros and cons

The savings in cycle time have already been mentioned. Since the extra flow that is achieved by pre-compression increases the effective shooting capacity of the machine, valve gating makes it possible to mold marginal shots that would normally be molded in larger machines. Conversely, where machine capacity permits, the extra bonus in flow can be taken up by reducing temperatures and pressure below those needed without valve gating.

Because the valves can be closed as soon as the cavities are filled, and because pressures are usually lower than normal, piece weights are lower in valve-gated cavities. Physical properties, particularly impact strength, are improved because the parts are freer from frozen-in stresses, poor welds, and weaknesses associated with packing around the gate areas. Scrap losses are reduced because there are fewer short shots, less warpage, no cracks around sprues, and no bubbles at the junction of sprue and piece.

Lowered material temperatures reduce defects due to degradation, such as the discoloration of light-colored compounds. Reduced temperature requirements also reduce the heat input per shot, and in cases where plasticating capacity is the limiting factor, faster cycles result. Finishing costs are eliminated and, since the operator need not be bothered trimming and recycling sprues and runners, his time can be used in inspecting, labeling, and packing the finished goods. From Fig. 2 it can be seen

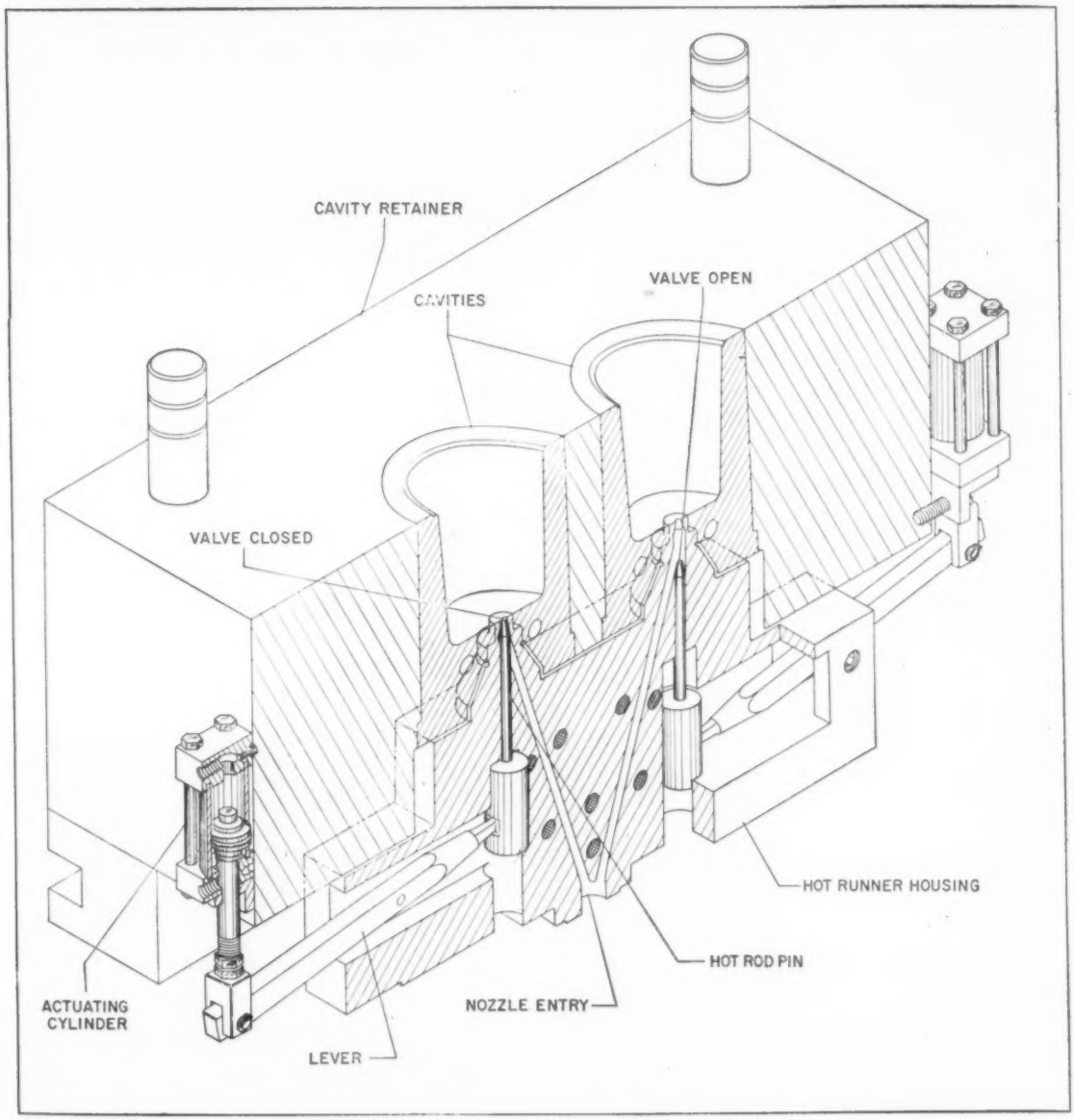
that in the closed position the top of the valve stem is flush with a flat surface in the piece. The entry point therefore has a better finish than those obtained with conventional hot-runner or pin-point gates. Since lower pressures can be used, flash is less of a problem.

Valve gating permits a high degree of automation. Aside from doing away with ejected runners, there are no problems with freezing off at the gate such as occur in conventional hot-runner molding when there is any disturbance of the cycle. Since the valves are shut when the mold is opened, a delay in ejection, for example, causes no special difficulty and the production cycle is resumed within minutes.

For valve gating to realize its full potential, careful attention must be given to the mold design. Sharp corners and other dead spots must be avoided. There must be adequate control of the temperature of the hot melt in the runners, as well as intelligent layout of cooling channels around the cavities (Fig. 3, p. 120).

With due care in construction, valve-gated molds need less maintenance on either the pins or the cartridge heaters. Another plus feature is this: if trouble does occur in one cavity, the valve to that cavity can be shut off and the repair work can be put off until the production order is completed. In an unvalved

Fig. 2: Design details of valve-gated mold. (Normally valves open and close together.) Cross-hatched ellipses symbolize cross-sections of cartridge heaters; clear ellipses above them stand for cooling channels. Air hydraulic lines to actuating cylinders are not shown



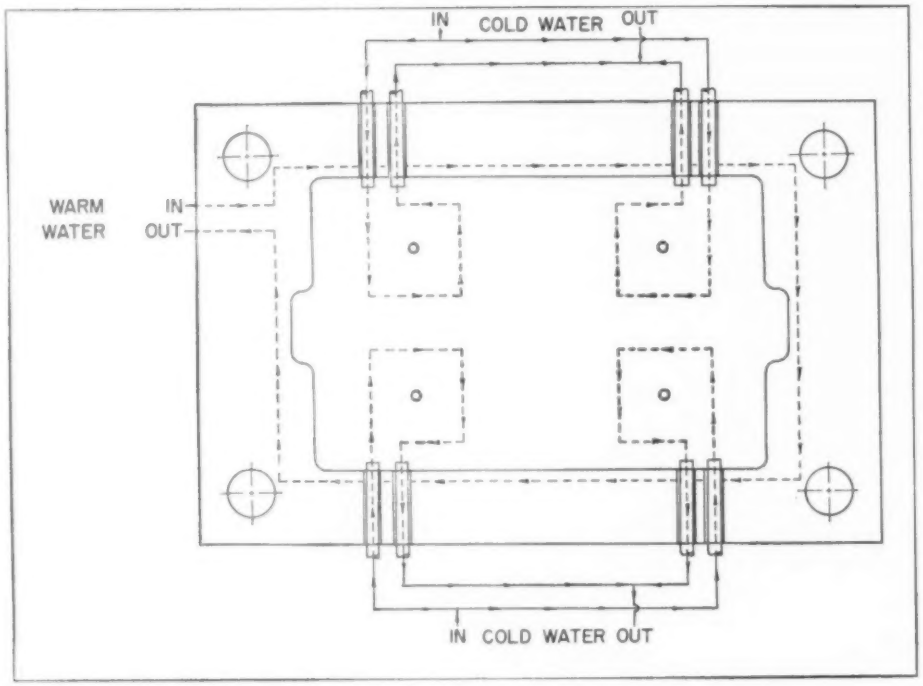


Fig. 3: Layout of cooling-water channels in 4-cavity valve-gated mold (end view). Because there is no danger of freeze-up at gates, as there is with conventional hot-runner molds, cooling water can enter close to gates to give desirable counter-current cooling. Note balance of layout that assures equality of temperature distributions in all four cavities

mold, the defective cavity would go on making defective parts until the end of the run, and these parts would have to be segregated and the material reclaimed by regrinding.

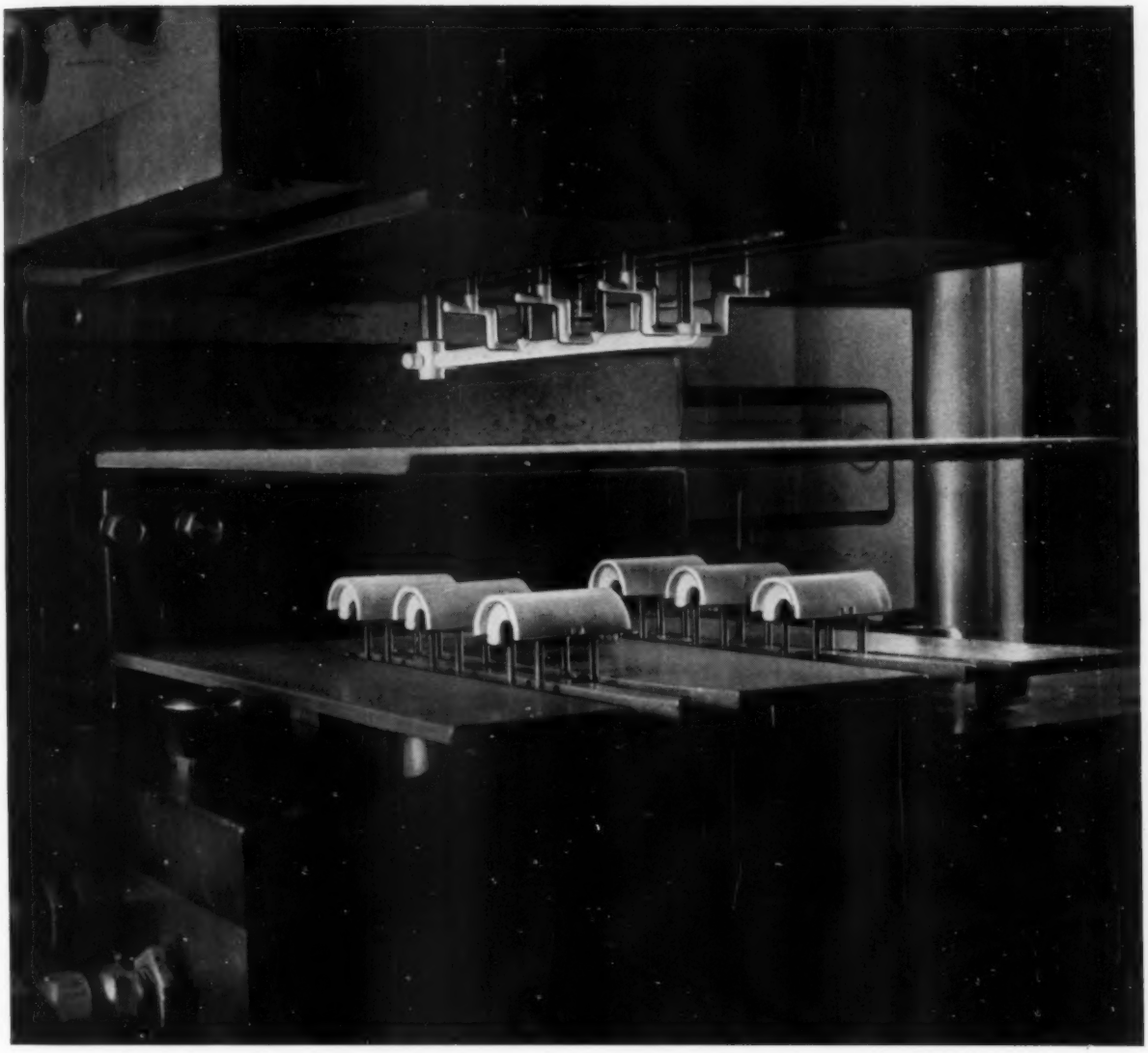
Valve-gated molds cost more than standard cold-runner molds, the difference amounting to as little as a few hundred dollars or as much as a few thousand, depending on complexity. However, the three-plate molds used in normal hot-runner molding and in some methods of pin-point gating may approach the cost of a valve-gated mold.

Typical cases

Figure 4, below, shows a polyethylene laundry basket that was originally run on an 80-oz. machine using a conventional tapered sprue. When this mold was valve gated, the cycle time dropped one-third, the part weight decreased from 30 to 28 oz., and it was satisfactorily molded on a 60-oz. machine.

In another job, a large wastebasket was converted from conventional gating and now has four valve gates. The production rate, in a 48-oz. machine, was increased 45%, while at the same time it was possible to drop the material temperature from 600° to 450° F. At the lower temperature it was possible to mold these

Fig. 4: Polyethylene laundry basket is molded in valve-gated mold. (Photo, Columbus Plastic Products)



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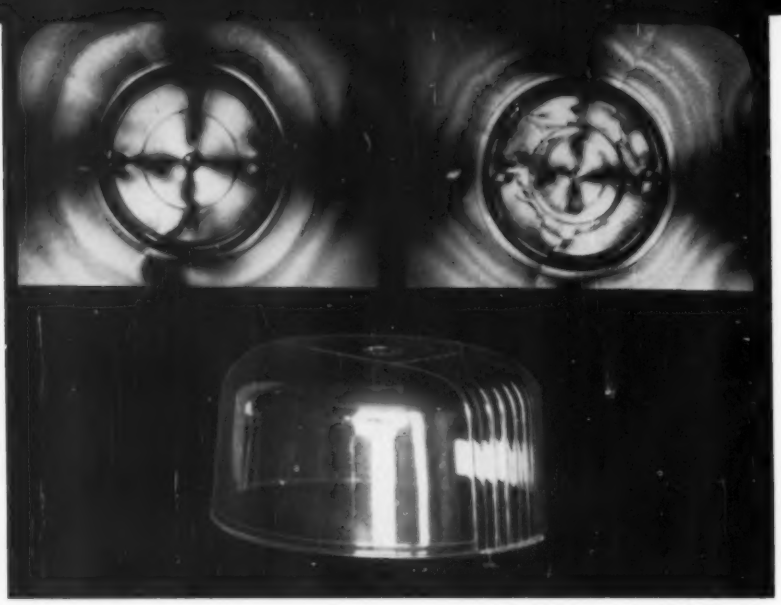

Fig. 5: 12-oz. cake-dish dome (lower photo) was first molded in a hot-runner mold with pin-point gate, which was later replaced by valve gate. Cylinder temperature of 16-oz. machine was 550° F. and cycle was 35 sec. with pin-point gate, 25 sec. with valve gate. Viewed by polarized light, pin-point-gated piece at right has much more frequent interference fringes, indicating higher internal stress levels. (Photo: Grace)

baskets from white-pigmented polyethylene that discolored at the higher temperature. There was also a reduction in piece shrinkage, and scrap losses were eliminated.

The polarized-light photos in Fig. 5, above, of a polystyrene cake-dish dome, show that the molded-in stresses were considerably less severe when the piece was valve gated than when it was pin-point gated.

In order to demonstrate just how important the pre-compression factor is, test moldings were made in a valve-gated mold for the bottom of a kitchen canister. This shell is about 5.5 in. in diameter at its bottom, 7 in. at the top, its height is 7.1 in., and the wall thickness is about 82 mils. It was molded in both high-density polyethylene and high-impact polystyrene, using a small valve gate located in the center of the bottom. The 16-oz. HPM was equipped with a polyliner-type cylinder, and the injection pressure was 20,000 p.s.i. With precompression, it was possible to fill this mold with the polystyrene at a cylinder temperature of 550° F., and a mold temperature of 80° F. on a 28-sec. cycle. The canister bottom weighed 7.9 ounces.

Under the same conditions, but without precompression (valves kept open at all times), the output consisted of short shots weighing 7.2 ounces. To fill the mold without precompression required raising the temperatures to 600° and 100° F. and lengthening the cycle to 34 seconds; the resulting piece was found to be 0.1 oz. heavier.

In molding the same piece from high-density polyethylene, the cavity was filled, with precompression, at a cylinder temperature of 530° F., a mold temperature of 135° F., and a cycle of 39 sec., to yield a piece weighing 6.6 ounces. Without precompression, at these conditions, the short shots weighed only 6.4 ounces. By raising the material temperature to 550° F. and lengthening the cycle to 56 sec., the canister could be filled out without precompression, and again the piece weighed 0.1 oz. more.

The rectangular wash basin of Fig. 6, below, molded from high-density polyethylene, is another case in point. This is a 14.5-oz. piece that was originally center gated and molded on a 12-oz. machine with a 60-sec. cycle. When this part was valve gated, the cycle was reduced to 45 sec., a 25% saving. Warpage, previously a problem, was eliminated, shrinkage was reduced and its uniformity improved, and the piece weight dropped from 415 to 404 grams. It was also possible to reduce the injection pressure and material temperature.

These cases are typical rather than exceptional. Valved gating nearly always results in shortened cycle, reduced part weight, better quality and uniformity of dimensions, milder molding conditions, and less down time and maintenance.

Valve-gated molds have been used in various makes of molding machines with nominal shot sizes ranging from 4 to 200 oz., and there seems to be nothing in the method that would bar it from use on any commercial injection machine.—END

Fig. 6: Wash basin made of high-density polyethylene was molded much more easily after mold was valve gated. (Photo: Columbus Plastic Products)

Designing stiffness into plastics structures

*By Sidney Levy**

The relatively low elastic moduli of plastics put them at a disadvantage to the metals in simple structural forms—bars, sheets, etc. However, their easy moldability makes it possible to design complex shapes having high stiffness but requiring no more material than the simple shapes. Thus a plastic shape, which may cost no more to fabricate than a simpler metal shape, may have equal resistance to bending loads but weigh much less than the metal part. The author discusses several approaches to designing for stiffness and gives examples illustrating the surprising power of these methods.

Various new plastics with greatly improved mechanical properties have widened the base of plastics applications to areas where, traditionally, metals and other structural materials have predominated. The new materials have improved temperature stability, high tensile and impact strength, and, in fact, excellent properties in every respect but one: they have much lower moduli of elasticity than the metals. As a result, the frequent design limitation is the required flexural stiffness rather than strength (see Table I, right).

Where conventional designs have been used, the stiffness requirement has led to the specification of extra-thick sections, with a consequent increase in material cost and expense of manufacture. In such cases the relative economic advantage of plastic over other materials may be lost, even when strict strength considerations strongly favor the plastics. This article will present ways in which increased stiffness can be designed into plastics parts with little penalty in increased material required and in ways that cause a minimum of interference with molding and fabrication processes.

Approaches to better stiffness

Flexural stiffness (i.e., stiffness in bending) and resistance to deformation of a structural member is proportional to the modulus of elasticity of the material (E) and the moment of inertia of the cross section of the member (I). The product of these two (EI) is called the stiffness factor and occurs in all analyses of deflection of members as the term which defines

(*To page* 126)

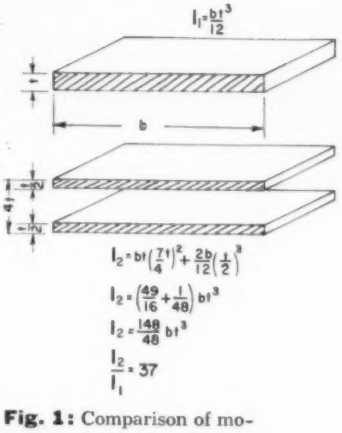

Fig. 1: Comparison of moments of inertia of cross sections of single slab and double slab of half thickness. The moment of inertia has been computed with reference to the central horizontal plane, that is, "neutral axis" in each case

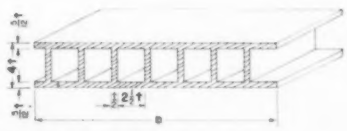

Fig. 2: Ribbed section with same moment of inertia as double slab of Fig. 1

Table I: Modulus of elasticity in tension of plastics and metals, 10^5 p.s.i.

General-purpose phenolic	8 to 12
Cellulose acetate butyrate (hard grades)	1.6 to 2
Nylon-6/6	2.1 to 4.1
Acetal resin (polyformaldehyde)	4.1
Rigid PVC	5
Polymethyl methacrylate	4
General-purpose polystyrene	4 to 5
Acrylonitrile-butadiene-styrene copolymers	2
Polyethylene, density = 0.96	1.5
Polyethylene, density = 0.92	0.3
Polytrifluorochloroethylene	1.5
Polytetrafluoroethylene	0.33 to 0.65
Polyester-glass laminates	20
Glass-reinforced phenolic	30
Glass-filled nylon	8
Glass-filled polystyrene	12
Epoxy-glass laminate	30
Unidirectional glass-epoxy laminate	60
Crossplied glass-epoxy laminate	40
Aluminum	100
Steel	300
Magnesium	60
White pine (air-dried)	22
White oak (air-dried)	18
Window glass	100
Concrete	20 to 50[a]

[a] Depending on proportions of various components and age of concrete.

* Professional engineer, 145 W. Cuthbert Blvd., Audubon, 6, N. J.

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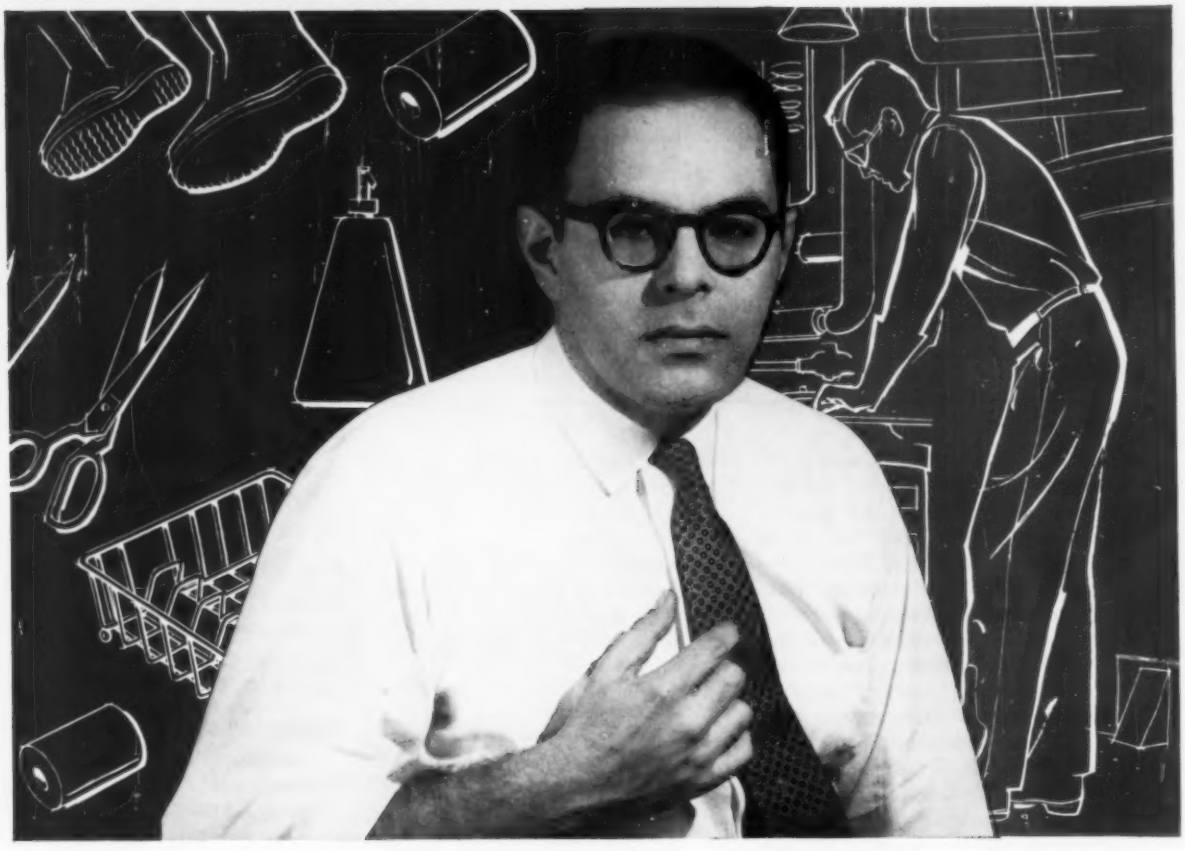

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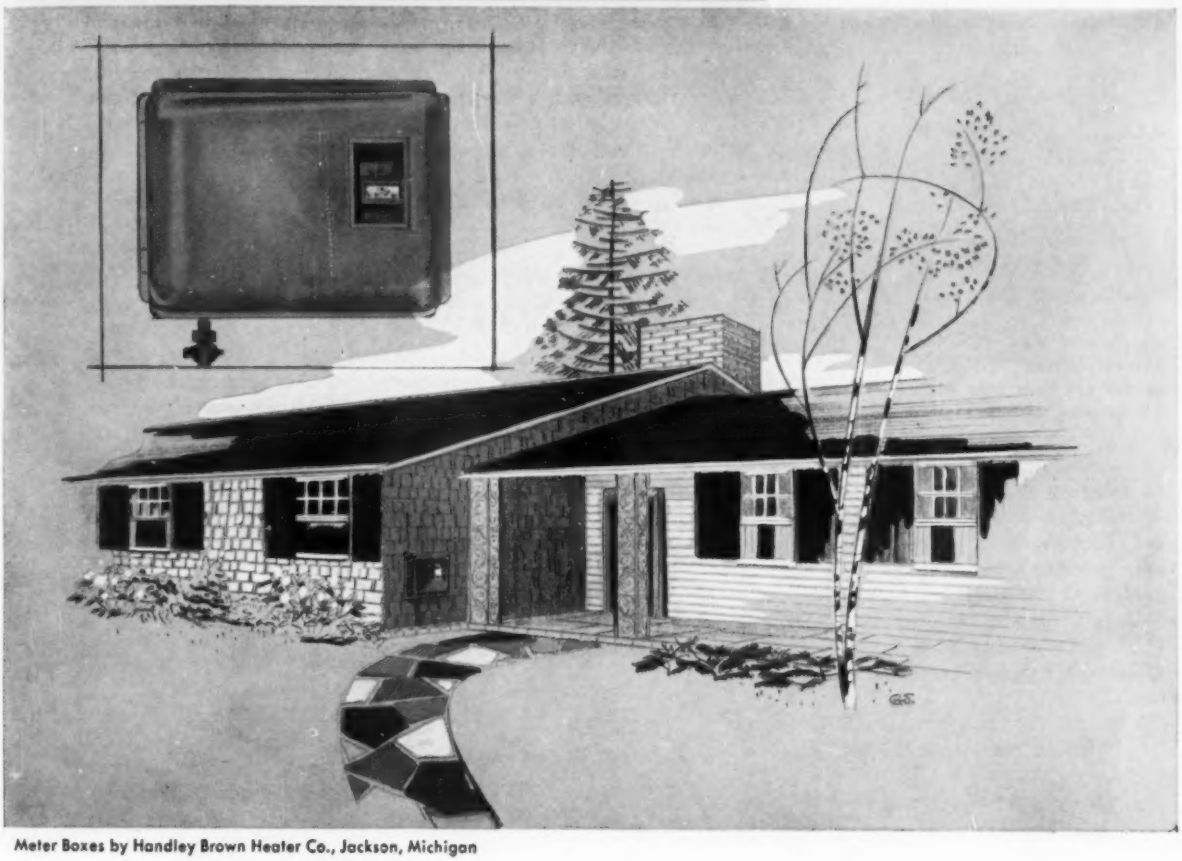

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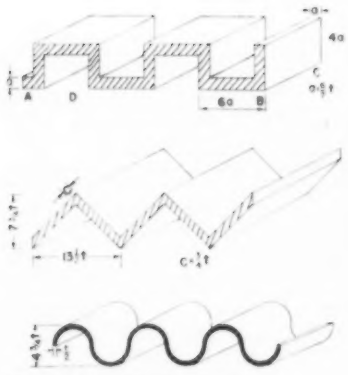

Figs. 3, 4, 5: These corrugated sheets are equivalent in crosswise stiffness to ribbed section of Fig. 2, but are not nearly as stiff in lengthwise direction

the amount of deflection for a given load, span, and type of support. In view of this there are three possible approaches to the problem of improved stiffness of a plastics member, namely:

1) Use materials of a type having a high inherent modulus of elasticity.

2) Design the member to have the highest practicable cross-sectional moment of inertia.

3) Make a composite structure, reinforcing the plastic at strategic points with a material having a high modulus of elasticity. (Polyester-glass laminates are an example of this type of structure.)

Each of the three approaches has been and can be applied to improve the stiffness of plastics members. The following analysis shows how each method may be employed and the degree of improvement that will result. It should be noted that the analysis ignores the effects of creep, but these can easily be included by using the apparent modulus method (see, for example, "Creep and stress-rupture behavior of rigid PVC pipe—Part I," MODERN PLASTICS, July 1958, p. 120, and "Part II," MODERN PLASTICS, Aug. 1958, p. 132.

Fillers and reinforcements

The first consideration is in the use of materials of high inherent modulus of elasticity to yield stiff members. Unfortunately, as was indicated above, this is one characteristic in which the plastics are relatively poor. The range of modulus for (unreinforced) plastics is from about 60,000 to 800,000 p.s.i, with a value of about 300,000 p.s.i. for many of the most useful thermoplastics (see Table I). This is in contrast with a range of 6,000,000 to 30,000,000 p.s.i. for the engineering metals. An additional problem is that the stiffer resins are usually more brittle, exhibiting poor impact strength and low elongation to fracture.

A great deal of work has been done on the incorporation of fillers and reinforcements, particularly fibrous glass, to improve the properties of the base resins. The addition of glass fiber (modulus = 10,000,000 p.s.i.) raises the modulus of elasticity of the plastics materials to the range of 1,000,000 to 6,000,000 p.s.i., with corresponding increases in impact, tensile, compressive, and flexural strength. However, this is done almost invariably at the expense of convenience and ease of molding and fabrication. The higher stiffness and strength values are obtained by the use of wet layup techniques using glass cloth and unidirectional reinforcement. The lower values are obtained in premix molding compounds of the polyester type and the injection and compression molding compounds formulated with chopped glass fiber as a filler. The latter compounds are difficult to mold and have variable properties depending on the molding conditions.

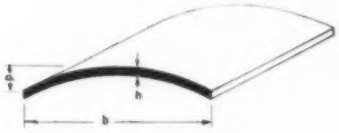

Fig. 6A: Sketch of cylindrically curved plate

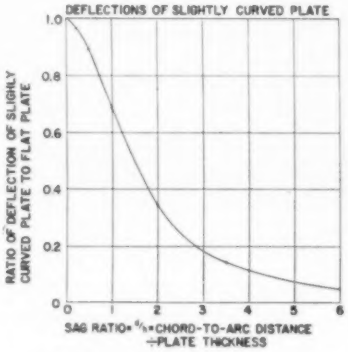

Fig. 6B: Graph shows comparative deflection of the curved plate—shown in Fig. 6A, above—as a function of the amount of initial curvature

As the art of formulation improves and the techniques of reinforced plastics molding are made automatic, these materials will play an increasingly important role in plastics structural members. At present, however, despite the successes of the reinforced plastics industry and the existence of several glass-reinforced molding compounds, this approach to improved stiffness is more potential than actual for most plastics parts. Except for large parts where the layup techniques do not increase the cost excessively or when the ultimate in properties is the governing consideration (in certain missile and aircraft applications, for example), glass reinforcement does not represent the most fruitful approach for the design engineer.

Thermal, chemical, and radiation methods

There are some other potential methods for improving the stiffness of plastics which are worthy of passing mention. In the case of highly crystalline polymers such as nylon and the new isotactic polyolefins, annealing and recrys-

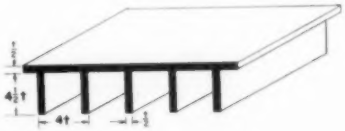

Fig. 7: T-beam construction used in most home roofing is also useful in stiffening the surfaces of plastics parts

Fig. 8: Bottom flanges on T-beams convert them to I-beams, which are stiffer in crosswise direction

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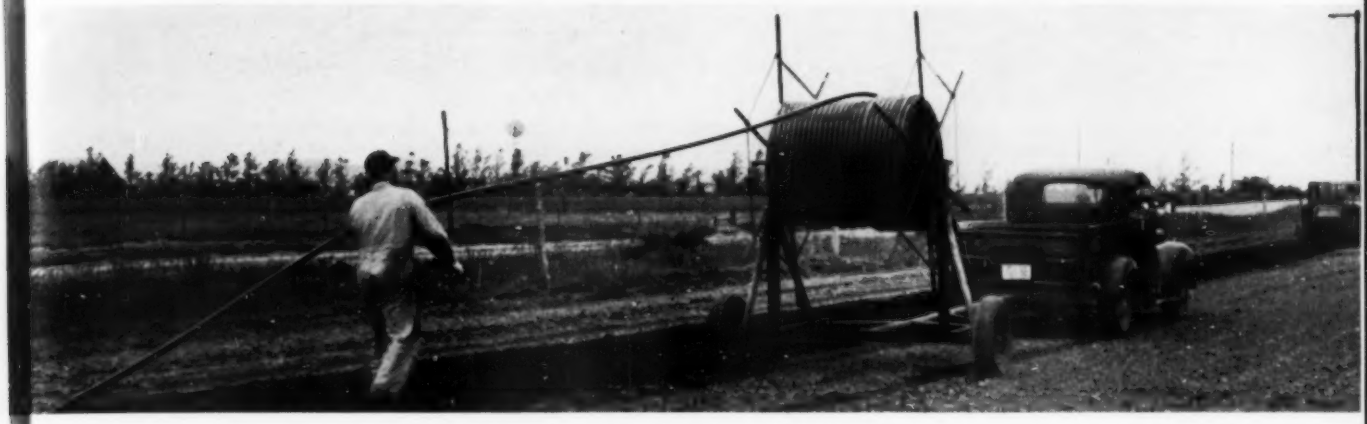

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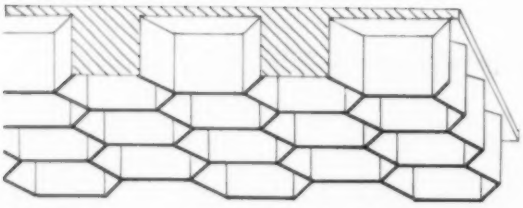

Fig. 9: Honeycomb ribbing attached to flat surface gives excellent resistance to bending in all directions

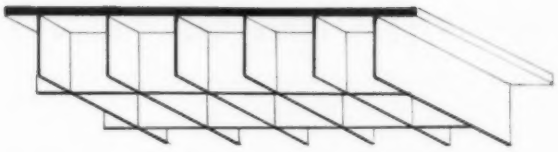

Fig. 10: Egg-crate ribbing also provides multidirectional stiffening, though not quite as isotropically as honeycomb

tallization of the crystallites improves the rigidity of the parts. The effect is not a major one but with the introduction of more crystalline polymers heat treatment may play an increasing role in plastics processing.

Another interesting technique is the chemical hardening of piece surfaces. This helps to improve the stiffness of the structure.

Probably the most significant technique is the use of high-energy ionizing radiation to cross-link polymers and improve their stiffness, particularly their high-temperature stiffness. Thus far, irradiation has been exploited mainly with polyethylene, but the literature is replete with reports of work on a wide variety of materials. While these are interesting potential methods they have relatively little effect; improvements in modulus are on the order of 50% or less.

Control of part geometry

The most important method of improving the resistance of structures to deformation (from the standpoint of the design engineer) is the control of the part geometry.

Given the material that must be used, there is a great deal that the design engineer can do to improve stiffness with little or no penalty in weight or moldability.

The several design approaches can be summarized as follows:

1) The use of integrally molded stiffeners such as ribs, beads, and bosses.

2) Distribution of the material in the walls in a manner that yields a high moment of inertia for the cross section.

3) The use of sandwich construction in which most of the material is in high-strength skins separated by low-density spacing cores.

Fig. 11: Typical sandwich construction, in which two strong sheets are bonded to lightweight separator. Lateral shear strength of bond is usually the load-limiting factor in such structures. If only one sheet is used, resulting "open sandwich" resembles the egg-crate structure of Fig. 10

4) The use of skins of high-modulus materials adhered to the surface of the parts to improve their stiffness. This can lead to some surprising improvements with little additional material but it is limited by the shear strength of the bond between the skin and the bulk of the part.

A hypothetical case

As a basis for analysis of the stiffness improvement let us compare two hypothetical materials: a plastic with a modulus of elasticity of 300,000 p.s.i and a metal with a modulus of 10,000,000 p.s.i., both in the form of sheets or plates. Using the well known relationship that the stiffness of a plate varies as the cube of the thickness it becomes apparent that for the plastic sheet to have the same stiffness in flexure as the metal sheet it must be approximately three times as thick. In many cases this will make the plastic part too costly in material and molding-machine time. Also, the thick walls have a poor appearance because of sink marks.

To see how construction geometry can increase stiffness, take as a basis a plate of thickness t made of the hypothetical metal. Using the same volume of material, can a plastic plate of the same stiffness be made? Shown in Fig. 1, p. 123, is the hypothetical plate and also the same plate slit into two of thickness $t/2$ and separated by a distance of 3t. The calculations accompanying the figure show that the split section has a moment of inertia which is 37 times that of the original plate of thickness t! Now let the two elements of the double plate be firmly connected so as to maintain the 3t separation and imagine the composite structure and the single plate to be subjected to equal vertical loads. If the composite were made of plastic of modulus 300,000 p.s.i. and the simple plate of a metal of modulus 10,000,000 p.s.i., the corresponding EI products would be 925,000 bt^3 and 833,000 bt^3. Thus the plastic composite would bend less than the simple metal plate.

Extrudable structure

While the split plate above is an idealized version chosen for simplicity, the extrudable struc-

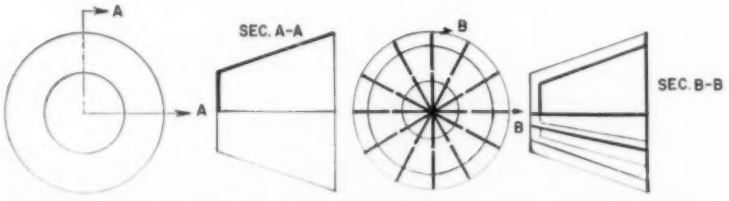

Fig. 12: Double-walled conical structure uses either foam or ribs to effect stiffening separation and linking of walls

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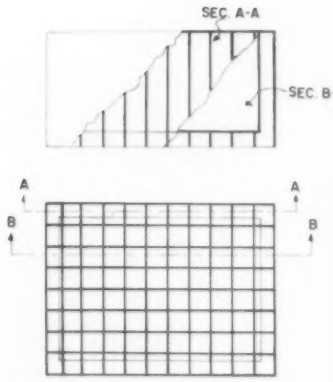

Fig. 13: A double-walled, box-like structure in which the bottom members are stiffened by egg-crate ribbing; the sides are stiffened by vertical ribs

ture shown in Fig. 2, p. 123, is a perfectly practical one that has the same moment of inertia. This type of structure can also be molded and formed in limited depths, or it can be fabricated. Note also that this structure is only 33% thicker than a solid plastic section of the same stiffness, weighs only 30% as much, and can be molded on a much shorter cycle because of the all-around thin sections. The number and size of the vertical spacer ribs in such structures are determined by the shear loads to be supported; the indicated proportions are more than ample for most applications.

The section shown in Fig. 3, p. 126, also has the same moment of inertia (shaded section), and, if supported along lines AB and CB, it will have about the same stiffness under load as the section of Fig. 2. This open corrugated section has the advantage of being easily molded, extruded, or formed from sheet. However, it suffers from the drawback that its stiffness is much lower if it does not have the crosswise support, i.e., if it is supported only along lines AD and BC. This is because the cross-section in the lengthwise direction is variable and has a considerably smaller moment of inertia, in most places, than does the shaded crosswise section. Still, it is stiffer than a flat sheet of the same width and thickness (a). If two-directional stiffness is needed, this corrugated sheet can be reinforced with crosswise ribs attached to the end faces or can be laminated to sheets on its top and/or bottom surfaces (as in walls of pasteboard cartons). The same general considerations apply to the corrugated structures of Figs. 4 and 5, p. 126, which have also been chosen to give the same crosswise moment of inertia as that of Fig. 3. The dimensions of these three configurations gives some notion of their relative efficiency, and on this basis the semicircular or rectangular type is preferred to the triangular one. The semicircular type offers the additional advantage that, having no sharp corners, it minimizes stress concentration.

Another way to improve the transverse stiffness using only a single sheet is to bow the sheet in the crosswise direction, as in Fig. 6A, p. 126. (This is the principle of the arch, and, if the bowing is carried out in two directions, a domed or dished sheet results. Such a sheet has improved stiffness in both the crosswise and lengthwise directions.) The graph in Fig. 6B gives the ratio of the deflection under load of a bowed plate to the deflection of a flat plate of the same thickness when both are supported along their edges. Thus a bowed plastic sheet having a sag ratio of about 6 would have the same deflection as a flat metal plate of the same thickness (using the previous modulus figures).

The graph serves here only as an indication of what is possible; variations in edge-support conditions can have a big effect on the size of the deflection. This type of wall—and even the spherical or domed section—is as easy to mold as a flat one and has greater esthetic value.

Molded-in stiffeners

Another method of improving the part is to mold-in a series of stiffening sections as is indicated in Figs. 7 and 8, p. 126. Both of these are equivalent to the structural practice of using *T* sections and *I* beam sections cast into flooring to stiffen them to support the required load. The proportions shown in Fig. 7 give an indication of the proportions required to match our hypothetical metal sections. Like the corrugated sections, these offer more stiffness crosswise than lengthwise.

Figures 9 and 10, p. 128, show two widely used two-dimensional arrays of ribbing which can effect stiffness in all directions in the sheet. The egg-crate pattern of Fig. 10 is easier to design into a mold and will give excellent stiffness in most directions but there is some preferential stiffness orientation. The honeycomb pattern of Fig. 9 is familiar from its use in structural sandwich panels and gives virtually omnidirectional stiffening. If a bottom plate is cemented to either of these, the resulting sandwich has essentially the same stiffness characteristics as the spaced half-t plates of Fig. 1.

Figure 11, p. 128, shows a sandwich structure in which the spacer may be a low-density foam, honeycomb, or an egg-crate pattern as shown in the previous figures. This type of wall has the most efficient use of material for omnidirectional stiffening. Fig. 12, p. 128, shows a part which makes use of the double wall spacer construction with spacer ribs. The two parts shown

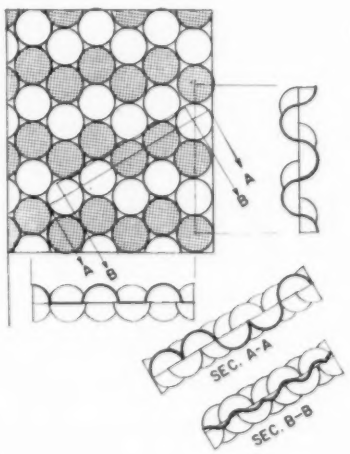

Fig. 14: Staggered hemisphere pattern offers good stiffness in most directions. Heavy lines in sectional views indicate cross sections in planes of cuts. Section B-B has low moment of inertia, low stiffness, would fold relatively easily

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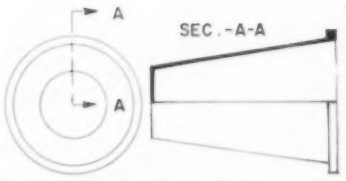

Fig. 15: Conical container gains much lateral stiffness by simple bead around lip

Fig. 16: Radial tapered ribs help stiffen this slab, also carry load to support points at corners

can be nested and the ribs cemented to the side wall to yield a rigid part. Alternatively, the ribs may be eliminated and the parts nested with the void between filled with a low-density foam. The foam must adhere to the walls in order to develop the required strength and the strength of the bond in shear must, likewise, exceed the maximum anticipated lateral shear stress at the interface.

Figure 13, p. 130, shows a one-part molding which uses stiffening spacers to give the side walls rigidity and an egg-crate bottom pattern to stiffen the base. The addition of a flat plate cemented to the bottom would make the structure still more rigid. In lieu of the stiffeners that are used, this section can also be filled with a low-density foam to insure rigidity.

These examples are only suggestions on how to apply the methods described; more appropriate methods to fit a particular part shape will readily suggest themselves. In almost every instance it should be possible to design a part with two cementable halves with a suitable supporting core molded into the part to give it the adequate rigidity that is required.

Figure 14, p. 130, shows a two-dimensional array of hemispheres formed from a flat sheet. Half the hemispheres are convex upwards, half downwards. The stiffening effect here is like that of the corrugations of Figs. 3, 4, and 5, except that it is much more nearly omnidirectional in character. A little study of the drawing will show that this pattern has no directions in which a line can be drawn that will lie wholly in the midplane; that is, no directions along which it can be folded as easily as a flat sheet of the same thickness. However, there *are* lines in the vertical direction and in the directions 60° from the vertical along which this pattern folds more easily than it does along any other direction (Section B-B in Fig. 14, for example). Most rigidizing patterns have one or two such directions.

Rigorous analysis of the load/deflection properties of such patterns is very difficult, but one spherically embossed configuration has been reported to yield an increase in flexural modulus of about a factor of five. Generally speaking, the further the material is displaced from the midplane and the fewer natural fold directions in the pattern, the more efficient the pattern will be in improving the rigidity of the surface.

Before leaving the subject of designing stiffness into a plastic part by altering the geometry of the part, the subject of ribs should be mentioned. Frequently one carefully placed rib or reinforced section can make the difference between a good and poor part.

The part in Fig. 15, above, shows how the addition of a bead at the open end of the conical part will add to the rigidity of the part without in any way complicating the molding. The resistance to crushing is that of the rim and not of the much thinner body section.

In Fig. 16, above, a method is shown for transferring a central load on a wall to the corners where it may be supported by heavy corner sections. Techniques like this enable a designer by judicious application of ribs and built-up corners to strengthen a part with the addition of a minimum of weight. The only danger is that the built-up sections may lengthen the molding cycle and show sink marks.

Composite structures

The third method for improving the stiffness of plastics parts is by reinforcement with small amounts of high-modulus materials. While reinforcing inserts come under this category they will not be covered since they represent a rather different area of combined plastic and metal parts. Very thin layers of high modulus materials such as nickel and steel adhered to the surface of plastics with high strength adhesives impart a greatly increased stiffness to plastics parts and this technique permits the manufacture of accurate stiff parts which compete with metals in many applications.

The technique is not limited to the use of metal layers. Layers of glass cloth are frequently cemented to the surface of reinforced plastics moldings to improve the rigidity of large flat areas. However, the use of thin metal films represents a fairly general technique of wide application and will be analyzed in some detail.

Figure 17, below, represents a small section of a beam made up of a plastic core having a modulus of 300,000 p.s.i. covered with a thin skin of a material of modulus 30,000,000 p.s.i.; e.g. steel or nickel. The modulus of elasticity times the moment of inertia of the section with and without the foil are compared. Let t = the thickness of the plastic part and T = the thickness of the foil and b = the width of the section.

$$I_{plastic} = \frac{bt^3}{12}$$

$$EI_{plastic} = 25{,}000\ bt^3$$

It is desired to make the beam

(*To page* 212)

Fig. 17: Sketch of laminated beam consisting of 40-mil-thick plastic reinforced with 2-mil steel foil on top and bottom surfaces. This composite has stiffness equal to that of a 40-mil thick aluminum beam, while it weighs only 7/10 as much

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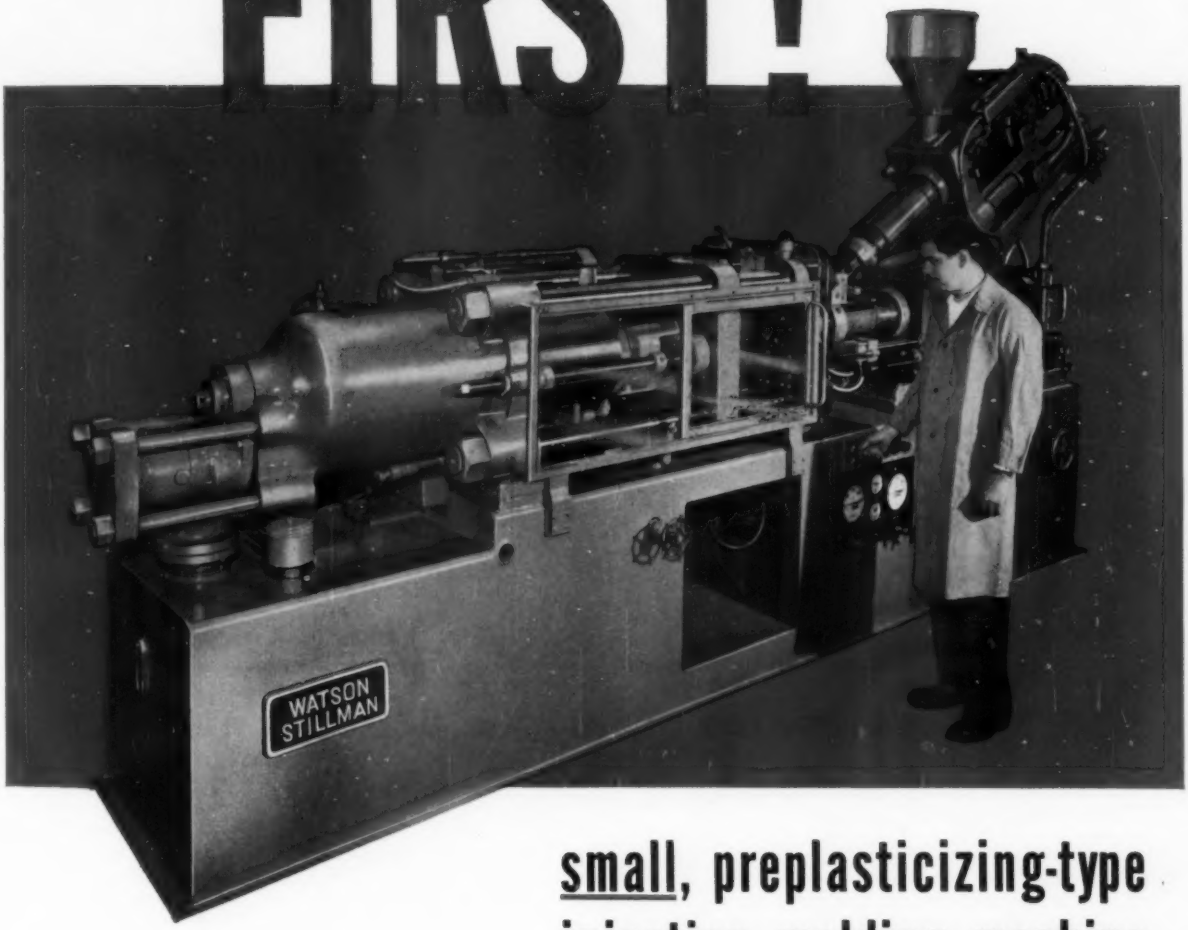

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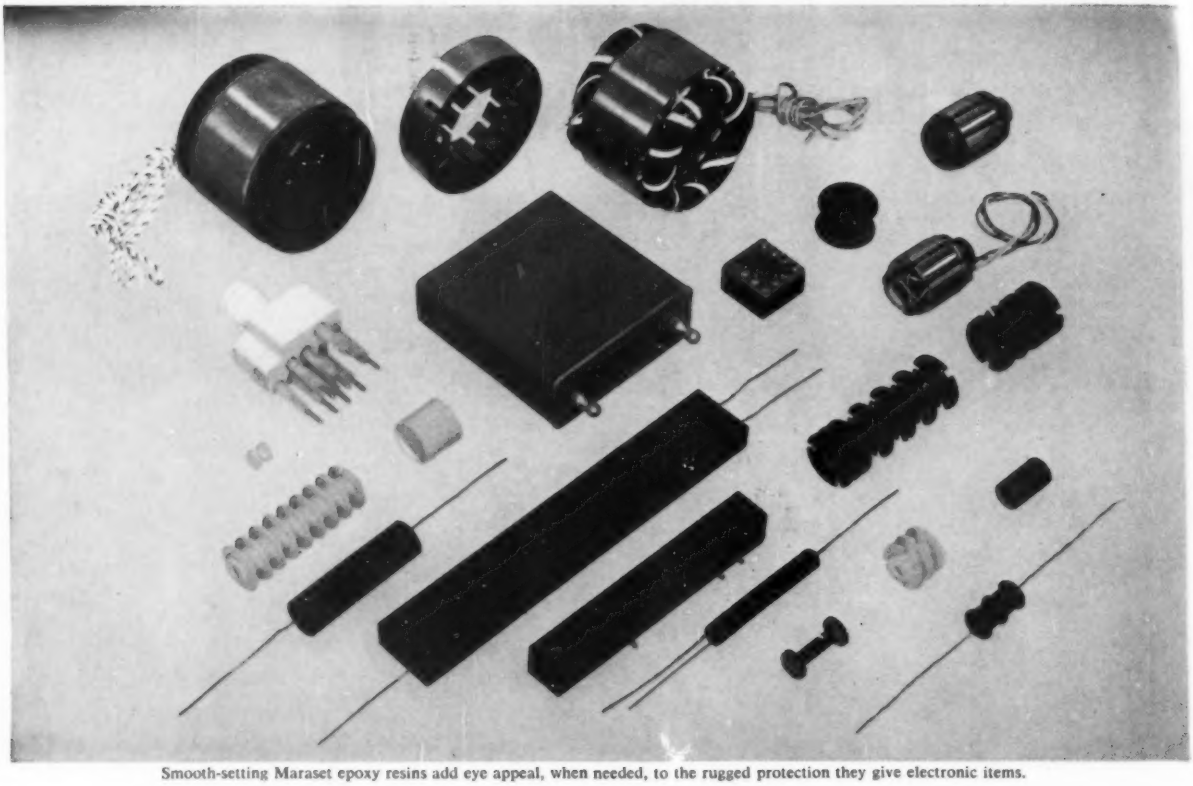

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Plastics* Technical Section

Dr. Gordon M. Kline, Technical Editor

Diaphragm behavior of plastic disks

By Albert G. H. Dietz† and Frederick J. McGarry†

The deflection of circular plates of methyl methacrylate was measured as a function of uniform gas pressure loading on one side of the plate, under two conditions of peripheral support: simply supported and clamped but not held. Twelve- and eighteen-inch-diameter plates were used in thicknesses of ⅛, ¼, ⅜, and ½ inch. The deflections were found to follow classical elasticity expressions for elastic plates with large deflections developed by Prescott (1).[1] The deflected surface of the plate could be approximated by a simple parabolic curve, the coefficients of which were approximately linear functions of gas pressure.

In many instances, use is being made of plastics materials in sheet or plate forms which are subjected to loads resulting from pressure differentials. Familiar examples include aircraft windows, skylights, light diffusing building panels, and various types of tanks or containers. Considerable design information is available for such applications with many materials but most of this is of an empirical nature frequently derived from prototype tests and difficult to correlate with theoretical expressions. The situation is further obscured by the fact that many investigations related to such use have concentrated upon the long-time creep or creep-rupture characteristics of the materials to the almost complete exclusion of the initial or short time load-deflection behavior. For these reasons it was decided to study the plate and shell action of a representative plastics material and explore the validity of using classical elasticity expressions to describe such a material's behavior.

*Reg. U.S. Pat. Off.

†Professor of Building Engineering, Director, and ‡Assistant Professor of Materials, Supervisor; Plastics Research Laboratory, M.I.T.

[1]Numbers in parentheses link to references at end of article, p. 139.

Apparatus

The testing apparatus is presented schematically in Fig. 1, right. It consists of a thick-walled steel tube with an internal shoulder machined into the bore. The test plate is supported on this shoulder and on the other or upper surface of the plate rests a thick annular ring of steel equal in width to the shoulder and the outer diameter of which permitted a snug fit of the ring into the tube. A second, similar ring is located a short distance above the floating ring and is firmly attached to the tube by a number of machine screws passing through the tube wall perpendicular to the tube axis. At frequent equal intervals around the mean circumference of the fixed ring, machine screws pass through it parallel to the tube axis, serving to lock the first, floating ring against the plate surface as they are tightened against it. Thus two conditions of

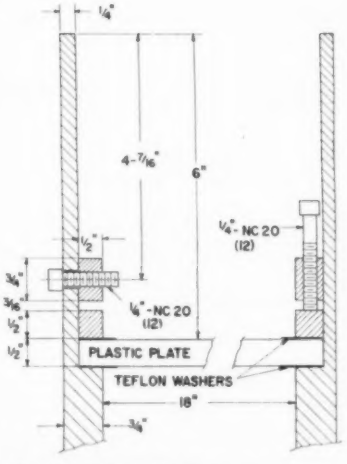


Fig. 1: Schematic diagram of test apparatus

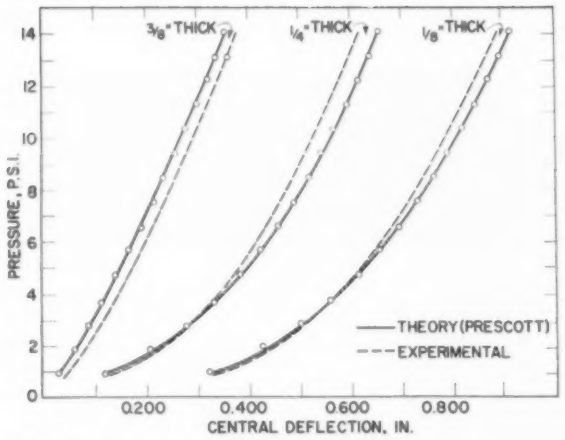


Fig. 2: Pressure *vs.* deflection. Simply supported, 12-in.-diameter plates

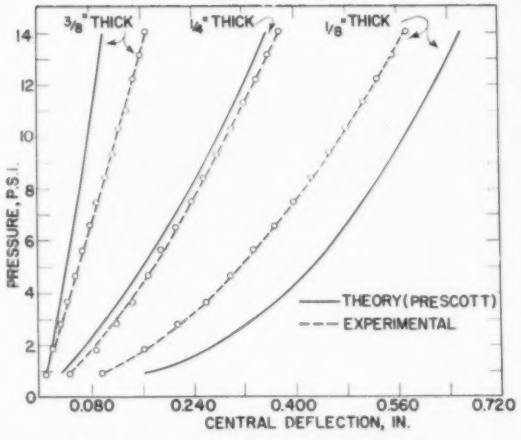


Fig. 3: Pressure *vs.* deflection. Clamped, 12-in.-diameter plates

plate support are available: without the use of the clamp rings, simple peripheral support exists and with their use, a clamped-but-not-held condition is obtained. In this latter condition, displacements of the plate parallel to its original, unloaded plane are permitted but the slope of the plate at its clamp is zero. To reduce the friction between plate and clamping surfaces, twin washers of 0.001 in. thick Teflon film were used. A caulking material was also used on the inner shoulder of the tube to prevent pressure leakage past the plate.

At the upper end of the tube an end plate with pressure connections was clamped to form, with the test plate and the tube, a pressure chamber. An aperture in the tube wall below the pressure chamber permitted access to the lower surface of the test plate for deflection measurements with an Ames dial gage of appropriate sensitivity. Dry nitrogen gas was the pressure medium and the pressure measuring device was a U-tube mercury manometer read with a meter stick attached to the tube support.

Two diameters of plates taken from commercially available cast acrylic sheet, Plexiglas II, UVA, were tested: 12 and 18 inches. In the 12-in. diameter tests, thicknesses of ⅛, ¼, and ⅜ in. were tested in both the simply supported and clamped-but-not-held conditions. Similarly, both conditions were tested for the 18-in.-diameter plates of ¼-, ⅜-, and ½-in. thicknesses.

Prior to commencing the acrylic plate testing, ¼-in.-thick aluminum plates were tested in the apparatus as a means of checking its operation; an action which suggested several minor modifications of apparatus or testing procedure for good results with the acrylic plates.

The initial tests with acrylic plates were designed to investigate any anisotropic characteristics of either the plates or the apparatus. Two perpendicular diameters were scribed on the lower surface of a plate, intersecting concentric circles previously scribed from the center of the plate in such a fashion as to divide the perpendicular diameters into one inch segments. The intersections so formed served as stations at which deflections measurements were taken at each pressure level. This process, repeated for the various plates studied, permitted the conclusion that no directional effects in the plane of the plate were present in the experiment. Stations along any one radius were used as measuring locations to determine the deflected profile of the plate at each pressure level.

Results

Theoretical expressions for the behavior of plates under the conditions attempted in this investi-

Fig. 4: Pressure *vs.* deflection. Simply supported, 18-in.-diameter plates

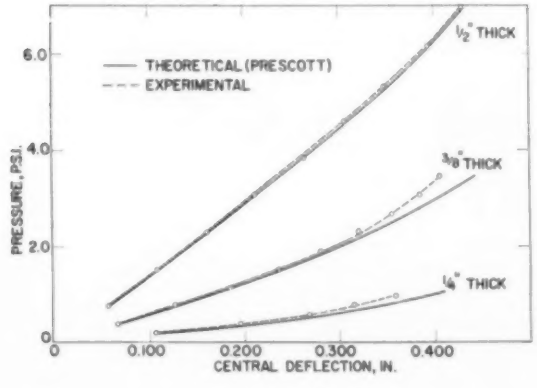
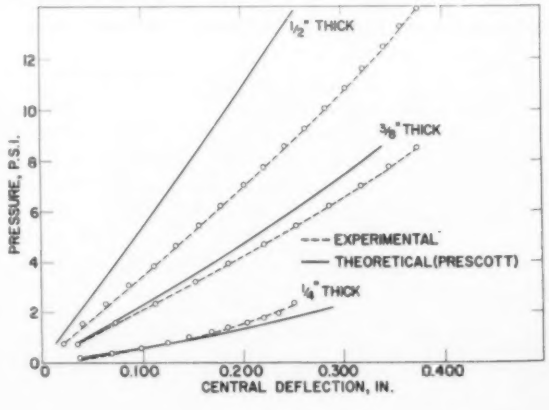


Fig. 5: Pressure *vs.* deflection. Clamped, 18-in.-diameter plates



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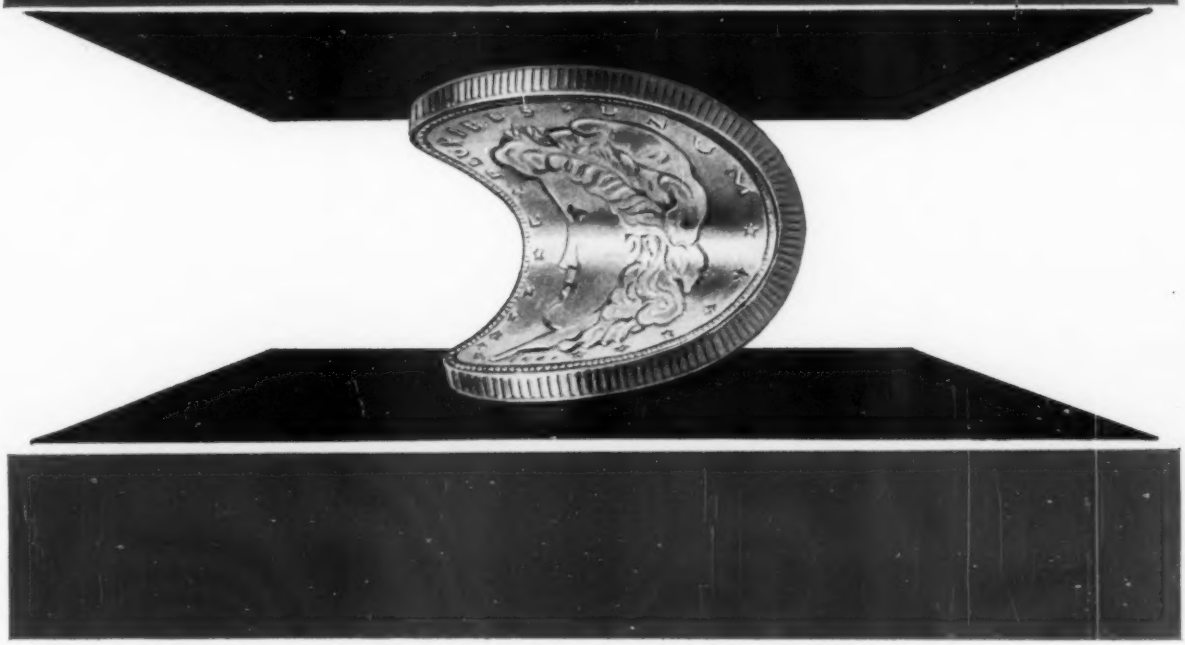

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gation are available from Prescott (1) and Roark (2). The expressions used refer to cases in which the deflections of the plates are large compared to the plate thickness (greater than ½ thickness) and diaphragm stresses or direct tension and compression exist in the middle surface of the plate. They are as follows:

Simple support:

$$\frac{wa^4}{Et^4} = \frac{64}{63\,(1-\mu)}\left(\frac{y}{t}\right) + 0.376\left(\frac{y}{t}\right)^3 \qquad \text{Eq. 1}$$

Clamped but not held:

$$\frac{wa^4}{Et^4} = \frac{16}{3\,(1-\mu^2)}\left(\frac{y}{t}\right) + \frac{6}{7}\left(\frac{y}{t}\right)^3 \qquad \text{Eq. 2}$$

where a = plate radius; w = differential pressure, uniformly distributed; t = plate thickness; y = maximum deflection of plate; E = modulus of elasticity; and μ = Poisson's ratio.

Figures 2, 3, 4, and 5, p. 136, demonstrate the degree of correlation between the above expressions and experimental results. In the simply supported cases, the agreement is considered acceptable; the clamped condition is much more difficult to achieve in practice. With the thinner clamped plates, some holding is apparent since the experimental deflections are less than predicted; as the plate thickness increases the reverse is true indicating that some rotation of the clamps takes place because of the increased rigidity of the thicker plates.

Because of the somewhat cumbersome nature of the above Prescott expressions, it was decided to explore the applicability of a simple parabolic relationship as a possible design procedure. For this purpose it was hypothesized that the deflection, y, at any radial distance, x, from the plate edge, could be represented by

$$y = K_1 x^2 + K_2 x \qquad \text{Eq. 3}$$

where K_1 and K_2 would vary with plate size, edge condition and pressure. To explore this idea deflection measurements were taken at the radial stations previously mentioned, at each pressure level. Representative examples of the results are presented in Figs. 6, 7, 8, and 9, below. From these graphs, it can be seen that, in most cases, the approximation is a reasonable one.

For each of these curves there was a pair of values of K_1 and

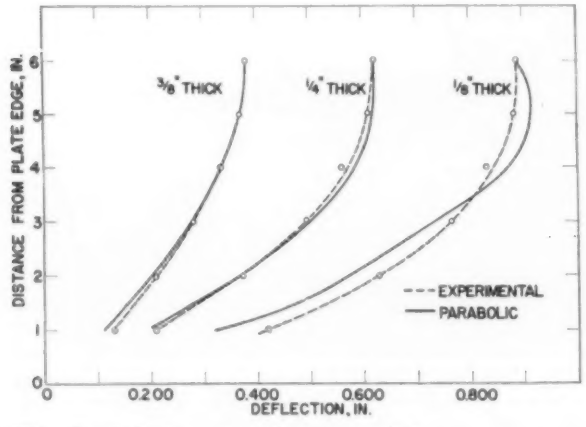

Fig. 6: Deflection of simply supported 12-in.-diameter plates at 14.0 p.s.i. pressure

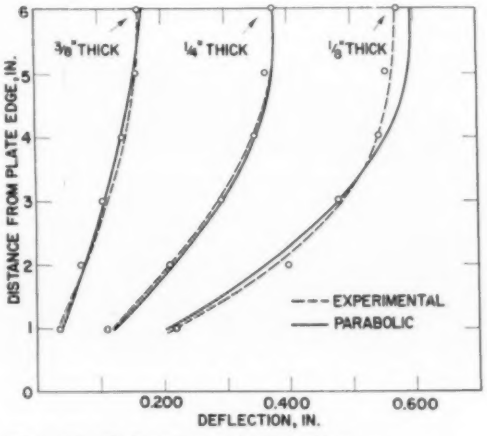

Fig. 7: Deflection of clamped 12-in.-diameter plates at 14.0 p.s.i. pressure

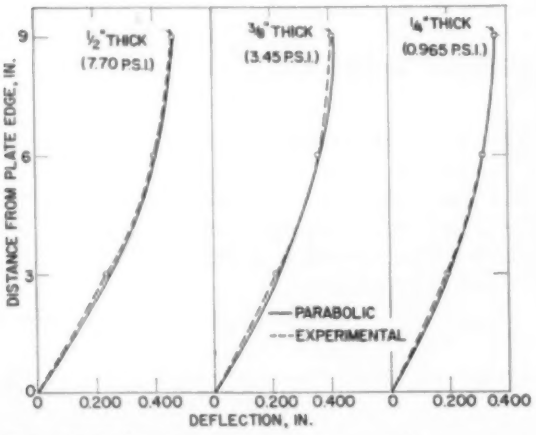

Fig. 8: Deflection *vs.* edge distance. Simply supported, 18-in.-diameter plates

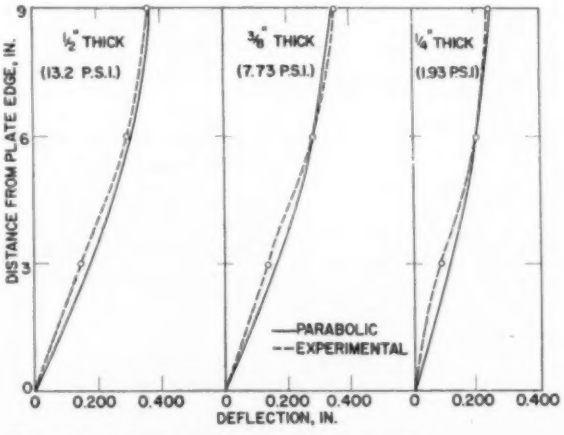

Fig. 9: Deflection-edge distance. Clamped, 18-in.-diameter plates

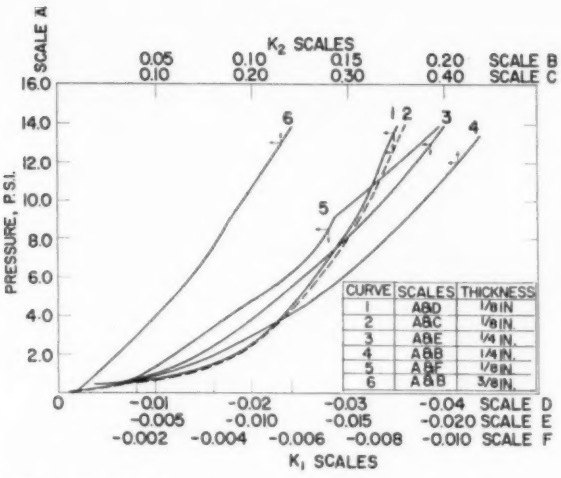

Fig. 10: K factors *vs.* pressure. Simply supported, 12-in.-diameter plates

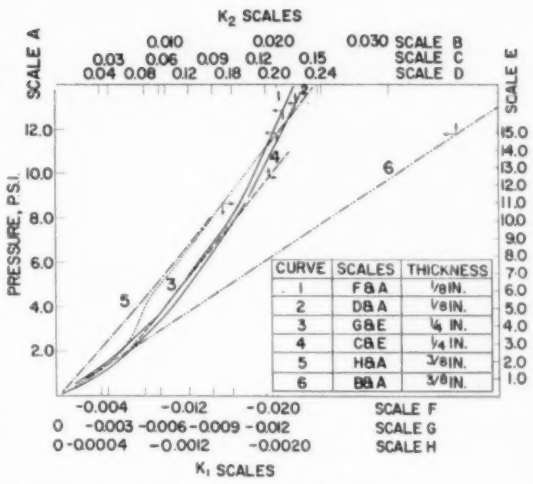

Fig. 11: K factors *vs.* pressure. Clamped 12-in.-diameter plates

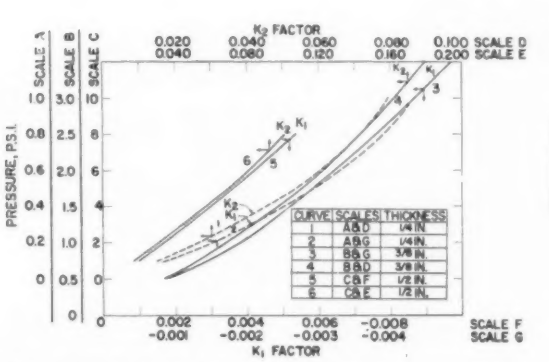

Fig. 12: K factors *vs.* pressure. Simply supported, 18-in.-diameter plates

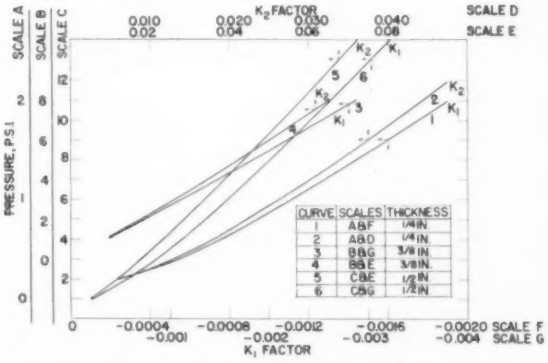

Fig. 13: Pressure *vs.* K factors. Clamped, 18-in.-diameter plates

K_2 corresponding to the thickness, diameter, differential pressure, and edge condition of the plate. It was then possible to plot K_1, K_2 *vs.* pressure for various thicknesses, etc., as in Figs. 10 through 13, above. It is apparent that considering these factors to be linear functions of pressure is in many cases adequate for engineering calculations.

Conclusions

The primary conclusions are:

1) When Plexiglas plates are loaded so as to behave as diaphragms, they do so in accordance with the predictions of classical elasticity analysis.

2) Satisfactorily obtaining other than simply supported edge conditions in this type of experimental approach is difficult.

3) The deflected profile of such diaphragm action plates can be satisfactorily approximated by a simple parabolic relationship.

4) The factors in the parabolic expression can be approximated as linear functions of pressure.

5) By intuitive reasoning, one would expect the stress distributions in these diaphragms to be also as predicted by classical analysis. Experimentally substantiating this inference is the next step in this investigation.

Acknowledgments

The bulk of this work was performed as theses by former students: Jentz (3) Borstein (4) and Ellison (5). The assistance of Charles Henrickson in performing many of the subsequent calculations is appreciated.

The plate material was supplied by W. F. Bartoe of Rohm and Haas Co. The investigation was carried out in the M.I.T. Plastics Research Laboratory which is supported by a Grant-In-Aid from the Manufacturing Chemists' Association.

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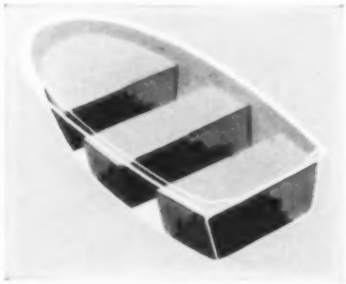

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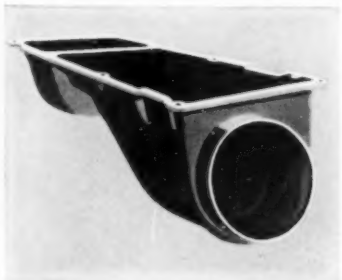

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Bonding properties of a solventless cyanoacrylate adhesive

By M. J. Bodnar and W. H. Schrader**

A new solventless anionic-polymerized room-temperature-curing adhesive, Eastman 910,[1] shows promise for use in the rapid bonding of components of many materials, particularly of certain Ordnance items that are now bonded with less convenient adhesives. In normal use, curing is accomplished by the catalytic action of moisture absorbed from the air; however, depending on the materials being bonded, this simple procedure may not yield good bonds. Prepared basic catalyst solutions are available to aid set-up in such circumstances. This versatile adhesive, and perhaps some similar compounds, should find widespread use if their cost can be sharply reduced.

In the bonding of many kinds of components it is advantageous to have an adhesive that is 100% reactive (i.e., contains no volatile solvents or latex media that must be evaporated out during setting), that sets at room temperature without pressure, and sets quickly. The absence of solvents eliminates the open time between application of the adhesive and assembly of the joint, and does away with weak points in bonds due to trapping of solvent or, conversely, to shrinkage upon evaporation. Room-temperature setting is useful for many assemblies that cannot be heated because of thermal sensitivity of the materials involved, costliness of appropriate heating equipment, or excessive heat-up time. Ideally, such an adhesive would come ready-mixed, so that the messy mixing operations can be avoided.

A new adhesive of this kind is Eastman 910, a cyanoacrylate monomer containing about 10% of plasticizer, stabilizer, and thickener. The polymerization of this adhesive is catalyzed by even the weakest of bases—atmospheric moisture usually furnishes enough OH^- ion to set up thin films in a few minutes. Where thicker layers must be set up, or where extra-fast setting is desired, special basic solutions are available from the supplier to speed setting (1).[2] Basic adherends, such as glass, cause the adhesive to set in a few minutes, and normal setting time for wood-to-wood bonds is about 5 minutes. Steel-to-steel bonds are strong enough to stand handling in about 20 sec., but reach maximum strength after 48 hr. at room temperature.

A sample of the new adhesive was furnished to Picatinny Arsenal for preliminary evaluation. Since it was then described only as an acrylate-type monomer containing some polymer, we decided to look into its chemical nature by means of spot tests, infra-red analysis, and literature research. The literature search disclosed the five Eastman patents (2-6); recently, the company has issued a product bulletin on this adhesive (1).

Chemical investigation

The infra-red spectrogram of Eastman 910 showed the presence of -CN groups, and a patent search revealed several issued patents that describe the preparation of monomeric alpha cyanoacrylates by depolymerization of the polymers formed by reacting a cyanoacetate with formaldehyde or a polymer of formaldehyde in the presence of a basic condensation catalyst (2, 3, 4). The monomers are readily polymerizable without the addition of heat or catalyst and therefore very difficult to store without premature polymerization. Since trace amounts of water can catalyze polymerization, an aqueous medium is highly undesirable during the preparation of the monomer from the polymer. A substantially anhydrous polymer can be prepared by carrying out the cyanoacetate-formaldehyde reaction in a nonaqueous organic solvent medium which distills below the depolymerization temperature of the polymer formed (2). Water formed during the reaction is removed azeotropically. Anhydrous polymer can then be depolymerized by heating in the presence of polymerization inhibitors such as sulfur dioxide and nitric oxide to yield stable alpha cyanoacrylate monomer of good stability.

Because of the inherent tendency of these monomers to polymerize, long shelf life of adhesive compositions based on such monomers is difficult to achieve. Incorporation of a gaseous inhibitor such as sulfur dioxide can serve as an effective method for storage of such an adhesive. However, large quantities of inhibitors can interfere with polymerization of monomer when used for bonding purposes. The addition of 0.05% by weight of hydroquinone and 0.001 to 0.010% of sulfur dioxide reportedly imparts good storage stability properties to the monomer without deleteriously affect-

*Plastics and Adhesives Research Section, Picatinny Arsenal, Dover, N. J.

[1] Eastman 910 is a patented product of Eastman Chemical Co. Use of tradenames does not express endorsement of product by the U. S. Army.

[2] Numbers in parentheses link to references at end of article, p. 148.

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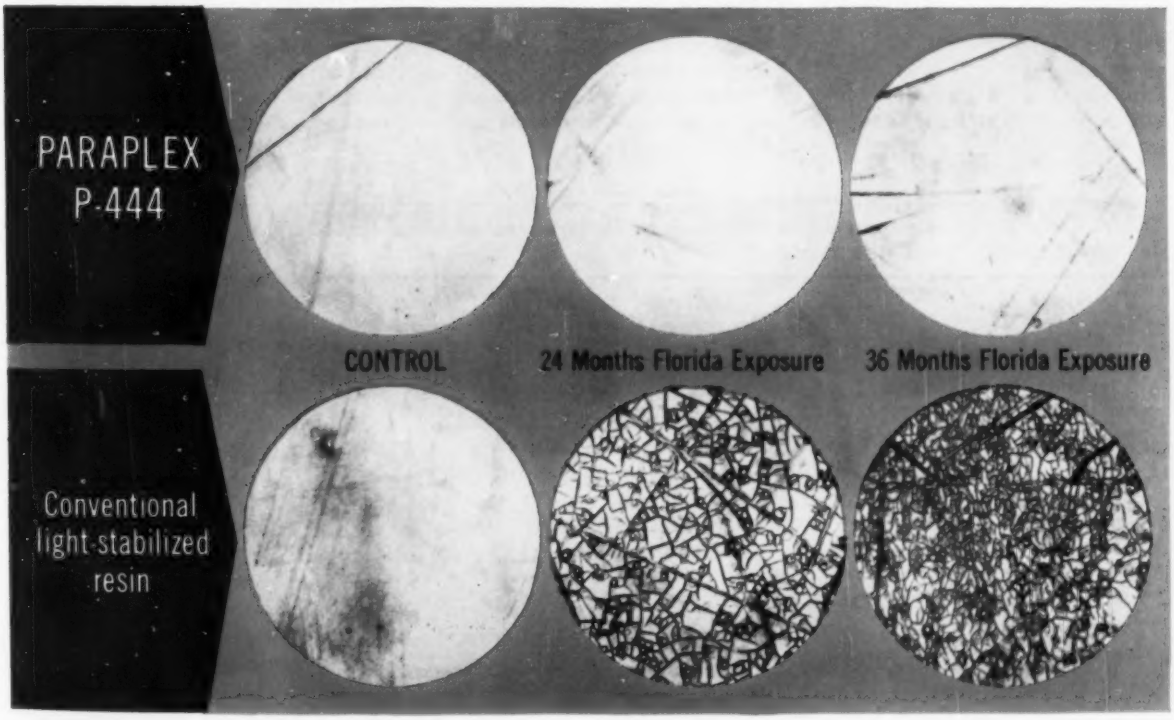

Table I: Tensile shear strengths of single lap steel-to-steel shear specimens bonded with Eastman 910 and Cycleweld C14[a]

Curing and exposure test conditions	Test temp.	Eastman 910			Cycleweld C14		
		No. of specimens	Tensile shear strength Range	Average	No. of specimens	Tensile shear strength Range	Average
	° F.		p.s.i.	p.s.i.		p.s.i.	p.s.i.
A. 1 day @ room temp.	73	6	3548-4180	3871	4	3060-3660	3430
B. 7 days @ room temp.	73	5	3760-4610	4176	4	2860-3820	3288
C. 7 days @ room temp.	−65	5	1680-2400	1920	4	2520-3060	2902
D. 7 days @ room temp.	160	5	2630-2840	2692	4	690-970	848
E. 7 days @ room temp. + 14 days at 160° F.		5	1840-2280	2154	4	3160-4110	3680
F. 12 days @ room temp. + cycling test[b]	73	5	3380-3620	3464	4	2530-3530	3185
G. 15 days @ room temp. + humidity test[c]	73	5	3410-3790	3594	4	2640-3310	2878

[a] All shear specimens were prepared with a single overlapped bonded area of 0.50 square inches. Failure on all specimens occurred at the adhesive-steel interface. No cohesive failures in the adhesives were noted.
[b] Cycling consisted of four days at temperature extremes of −65 to 160°F. (each day consisted of 8 hr. at −65°F. followed by 16 hr. at 160°F.). The specimens were then subjected to 2 days at −80°F.
[c] Humidity test consisted of 7 days exposure at 100°F. and 95% relative humidity.

ing adhesive properties (5). Bonding properties of the monomer, so stabilized, can be realized in some cases in as little as a few seconds after application of a thin film at room temperature.

Lower alkyl esters of alpha-cyanoacrylic acid polymerize more rapidly than the higher esters. Accordingly, the methyl ester is probably preferable for quick-setting adhesive bonding applications. However, an adhesive composition based on pure monomer would probably be undesirable from an application standpoint because of its low viscosity. A preferable adhesive composition of higher viscosity can be obtained by incorporation of up to 25% of polymers soluble in the monomer such as polymeric alkyl cyanoacrylates, polyacrylates, polymethacrylates, or cellulosic esters (5).

The exact identity of the alkyl ester(s) in Eastman 910 has not yet been announced, but the polymer content is about 10% (1). But this formulation is still rather fluid—thin bonds are strongest—and two coats are recommended in bonding porous or rough surfaces.

Bonding tests

Steel-to-steel shear strength specimens bonded with Eastman 910 were prepared at ambient room temperature conditions according to Federal Specification MMM-A-175. Groups of specimens were subjected to various curing periods and storage exposure conditions prior to testing for tensile shear strength in a Universal Testing Machine according to Federal Specification MMM-A-175. Testing temperatures were −65, 73, and 160° F. Additional sets of specimens bonded with Cycleweld C14, a modified room-temperature-setting epoxy adhesive supplied by Cycleweld Cement Products Div. of Chrysler Corp., were included as controls for comparison because of the generally known properties of this adhesive. Tensile-shear strength results, given

Table II: Tensile shear strength at 73° F. of single lap aluminum-to-aluminum shear specimens bonded with Eastman 910[a]

Metal surface precleaning treatment	Curing and exposure test conditions prior to testing	No. of specimens	Tensile shear strength Range	Average
			p.s.i.	p.s.i.
A. Wiped with acetone-saturated clean cloth followed by vapor degreasing in perchloroethylene.	20 days @ room temperature	5	1680-2460	2083
B. Same as A followed by wiping with a methanol-saturated clean cloth.	" " " " "	5	1560-2488	1988
C. Same as A	6 days @ room temperature + 14 days at 160° F.	5	1040-1460	1195
D. Same as A followed by wiping with a methanol-saturated clean cloth.	" " " " "	5	1160-1650	1394

[a] All specimens were prepared with a single overlapped bonded area of 0.50 square inches.

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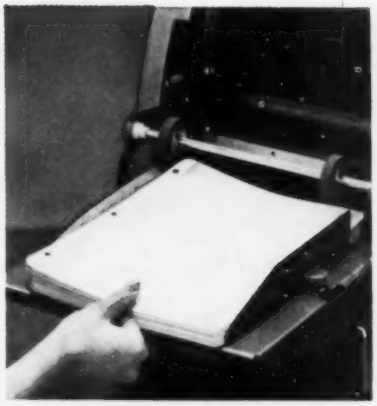

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Table III: Tensile shear strength at 73°F. of single lap plastic-to-plastic shear specimens bonded with Eastman 910[a]

Type plastic adherend	*No. of shear specimens*	*Cure time at room temperature prior to testing*	*Average tensile shear strength*	*Bond area appearance*
		days	*p.s.i.*	
A. Polymethyl methacrylate	2	1	147	Adhesive films firm, hard.
" "	2	2	218	" " " "
" "	2	4	441	" " " "
B. Polystyrene	2	1	44	Adhesive films tacky, uncured.
"	2	2	70	" " slightly tacky.
"	2	4	111	" " firm, hard.
C. Cellulose nitrate	2	1	835	Adhesive films firm, hard.
" "	2	2	730	" " " "
" "	2	4	770	" " " "
D. Rigid polyvinyl chloride	2	1	208	Adhesive films firm, hard.
" " "	2	2	240	" " " "
" " "	2	4	240	" " " "
E. Melamine-glass cloth laminate	2	1	372	Adhesive films v. slightly tacky.
" " "	2	2	690	" " firm, hard.
" " "	2	4	682	" " " "
F. Phenolic-paper laminate	2	1	92	Adhesive films fluid, uncured.
" " "	2	4	38	" " " "
" " "	1	8	48	Adhesive film soft and tacky.
" " "	1	8	340	" " firm, hard.
G. Polyester-Fiberglas laminate	2	4	20	Adhesive films fluid, uncured.
" " "	2	8	6	Adhesive films soft and tacky.

[a]All shear specimens were prepared with a single overlapped bonded area of 0.50 square inches.

in Table I, p. 144, indicated that Eastman 910 cures rapidly at room temperature to give good bonding strength after 24 hours.

The most significant limitation of the adhesive was its performance after elevated-temperature storage. Specimens stored at 160° F. for 14 days showed some loss of original tensile shear strength. However, since acidic surfaces reportedly tend to inhibit polymerization of alpha-cyanoacrylate esters (2), it was felt that possibly the chromic acid etching procedure used to clean the steel surfaces prior to bonding had been responsible to some degree for the breakdown of Eastman 910 during elevated-temperature storage (6). Therefore, in subsequent tests for bonding aluminum to aluminum it was decided to exclude acid precleaning of the surface in order to eliminate this factor from consideration. The aluminum surfaces were precleaned by sandblasting and vapor degreasing with perchloroethylene prior to bonding. Also, since polymerization of cyanoacrylate monomers is catalyzed by monohydric alcohols, it was decided to include in the tests sets of bonded specimens additionally precleaned by wiping with a cloth saturated with methanol.

Table IV: Tensile shear strength at 73°F. of single lap plastic-to-steel shear specimens bonded with Eastman 910[a]

Type plastic adherend	*Tensile shear strength*
	p.s.i.
A. Polymethyl methacrylate	540
B. Polystyrene	BHPB[b]
C. Cellulose nitrate	788
D. Rigid polyvinyl chloride	448
E. Melamine-glass cloth laminate	2060
F. Phenolic-paper laminate	940

[a]All specimens were prepared with a single overlapped bonded area of 0.50 square inches. All specimens were cured at ambient room temperature and humidity conditions for 2 days prior to testing. [b] Bond held. Polystyrene adherend broke.

Aluminum shear samples bonded with Eastman 910 were prepared at room temperature and tested according to Federal Specification MMM-A-175. Test results as shown in Table II, p. 144, indicated that Eastman 910 loses some tensile shear strength upon elevated-temperature storage at 160° F., corroborating the findings for bonding steel to steel. Precleaning with methanol did not significantly affect the ultimate shear strength results in these tests.

Plastic-to-plastic shear specimens were prepared by bonding with Eastman 910. The effect of variations in the time of cure at ambient room temperature on bond strength was determined as shown in Table III, above. Cellulose nitrate surfaces were readily attacked and softened by the adhesive when applied, indicating probable solubility of this plastic in the adhesive. Rapid adhesive curing rate was noted with maximum bond obtained within 24 hr. of cure at room temperature.

For bonding various other plastics to themselves it was noted that the rate of cure of the adhesive and subsequent shear

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strength varied considerably depending on the plastic. Most were less effective in promoting adhesive polymerization than were steel and aluminum surfaces.

In bonding phenolic plastic to itself and polyester plastic to itself, polymerization of Eastman 910 was considerably inhibited. Very poor bond strengths and soft, tacky, uncured adhesive films were noted in bond areas when these specimens were tested after eight days' cure time at room temperature. These findings along with results for bonding polymethyl methacrylate, polystyrene, polyvinyl chloride, and melamine plastics are shown in Table III.

Inhibition of cure of the adhesive in contact with polyethylene and tetrafluorethylene resin surfaces was also noted during preliminary tests. Specifically, 25- to 30-mil-thick layers of Eastman 910 cast on steel and polyethylene surfaces and allowed to stand at ambient room temperature and humidity conditions were observed to react differently. On steel the adhesive polymerized to a clear hard film within several hours, whereas on polyethylene it remained unpolymerized and fluid up to 72 hours. Application of the basic solutions mentioned earlier would probably cause rapid polymerization even on a polyethylene surface, but at the same time this work was done these solutions were not available.

Plastic-to-steel specimens were prepared by bonding with Eastman 910. All specimens were cured at room temperature for 48 hr. and then tested for tensile-shear strength according to Federal Specification MMM-A-175. The results (see Table IV, p. 146) show that although some plastics by themselves tend to inhibit adhesive cure and are difficult to bond to themselves satisfactorily, the same plastics can be readily bonded to steel due to the apparently enhancing effect of this metallic adherend on the curing rate of the adhesive. Specific examples were bonding of steel to polystyrene and phenolic.

Rubber-to-steel peel specimens bonded with Eastman 910 were prepared at ambient room temperature conditions according to Federal Specification MMM-A-175. Both cured GR-S and cured neoprene type rubber strips, size 1 by 12 by ⅛ in., were included in the tests. Within a few hours after preparation, manual testing indicated that it was impossible to remove the rubber adherends from the steel without tearing the rubber. Failure during testing in a Universal Testing machine was always in the rubber adherends (see Table V, below). Subsequent exposure of these test specimens to a relative humidity of 95% at 100° F. for seven days did not affect the bonds.

Eastman 910 exhibited excellent bonding of glass to glass at room temperature. In this assembly, two 3- by 3- by $\frac{3}{32}$-in. glass plates were joined together along a glue line area of approximately 3 by ⅛ in.; here a direct corroboration of the reported catalytic effect of alcohols on the curing rate of this adhesive was obtained. Specifically, clean glass plates prewiped with a clean cloth dampened with methyl alcohol and allowed to air-dry 1 to 5 sec. immediately prior to adhesive application and joint assembly, gave bond strengths within 10 min. which could not be overcome by cleavage and torsional stresses applied manually. Another assembly prepared in a similar manner except without the alcohol prewipe showed uncured adhesive and poor joint strength after 20 minutes.

This adhesive has also been used satisfactorily for rapid, room-temperature bonding of the end faces of Buna N rubber strips so as to form rubber rings with high strength, bonded butt joints.

Table V: Peel strength at 73°F. of rubber-to-steel peel specimens bonded with Eastman 910

Type rubber adherend	*Curing and exposure conditions prior to test*	*Peel strength*
GR-S	22 hr. at ambient room temp.	BHRB[a]
Neoprene	22 hr. at ambient room temp.	BHRB[a]
GR-S	2 weeks at ambient room temp., followed by 7 days at 100°F. and 95% relative humidity.	BHRB[a]
Neoprene	2 weeks at ambient room temp., followed by 7 days at 100°F. and 95% relative humidity	BHRB[a]

[a] Bond held. Rubber adherend broke in tension from load application.

Limitations

Eastman 910, still in the experimental production stage of development, is very expensive. The high selling price is attributed by the manufacturer to the high reactivity which makes the adhesive difficult to prepare.

This same high reactivity may result in storage stability difficulties. Also, it is felt that in certain production bonding applications in the shop, close supervision of application techniques (adhesive film thickness, open time) may be necessary because of adhesive sensitivity to variations in temperature and humidity which will affect polymerization (curing) rate.

Apparently certain surfaces inhibit anionic polymerization of α-cyanoacrylate monomers to such a degree that bonding without the aid of a prepared basic catalyst is either unfeasible or at best very slow in strength development.

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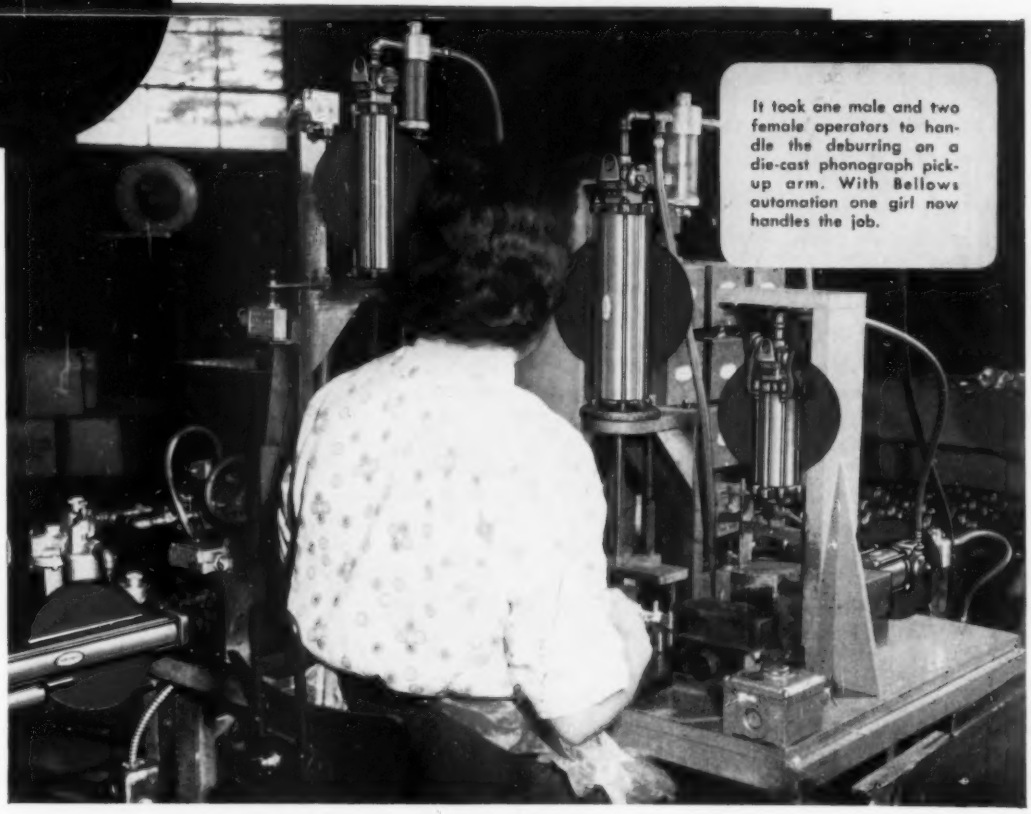

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General

New graduates: new degree. Chem. Eng. News *36*, 82-3 (June 16, 1958). Lowell Tech graduates the first class of eight plastics engineers.

Future of glass-reinforced plastics. J. H. Collins. Plastics (London) *23*, 161-2 (May 1958). Progress in the field of glass-reinforced plastics during the past 15 yr. is reviewed. Economic factors and technical applications in the aircraft and transportation industries are discussed. Future developments in the field are expected to result in more effective use of the present materials and of new fibers and resins, and to take greater advantage of new developments in molding practices and techniques.

Plastic materials in the cheese-making industry. G. Longoni Poliplasti *6*, 17-19 (Jan.-Feb. 1958). Applications of plastics, mostly PVC, in the cheese factories are described.

Materials

New developments in the manufacture of phenolic molding materials. E. Schneider and D. H. M. Brooks. Plastics Inst. Trans. *26*, 117-36 (Apr. 1958). Compounding methods for phenolic molding materials and their effects on properties of the resulting product are discussed.

Radiation processing of unfilled polyester resins. E. L. Colichman and J. M. Scarborough. J. Appl. Chem. *8*, 219-23 (Apr. 1958). Four commercial polyester resins, including both styrene and diallyl phthalate modified materials, were evaluated for the effects of gamma-irradiation. Tensile properties, Barcol hardness, and heat distortion properties were evaluated for thermally-cured, post-irradiated samples, and for radiation cured materials, containing no catalyst. Thermally cured materials were subjected to dosages ranging from 1×10^6 to 5×10^7 rad. Radiation curing was accomplished in the dose range of 5×10^5 to 8×10^7 rad. In general, radiation curing produced no great improvement in tensile properties over the thermal cure, nor did radiation after thermal cure cause any general improvement. Barcol hardness and heat distortion properties were unaffected by the radiation treatments.

Vinyl epoxy plasticizers. The epoxyhexahydrophthalates. F. P. Greenspan and R. J. Gall. Chem. Eng. News *50*, 865-67 (June 1958). A new series of improved epoxy plasticizers, the alkyl epoxyhexahydrophthalates, was developed. They possess good over-all plasticizing efficiency combined with excellent stabilizing properties, protecting polyvinyl chloride resins against degradation caused by heat and light exposure. They show outstanding compatibility at high concentration use levels, with no evidence of bleed even after prolonged exposure to light, and are recommended for use as primary plasticizers. As combination epoxy stabilizer-plasticizers they are applicable to a wide range of vinyl resin formulations and products.

Glass-flake paper—a new electrical insulation material. L. M. Conklin and M. P. Koerner. Elec. Manuf. *61*, 87-91 (June 1958). Molded glass fiber-polyester insulators which originally replaced molded glass-bonded mica were unsatisfactory because of long term voltage endurance problems. Phenolic-resin laminates with glass-flake paper as a reinforcement have shown improved properties compared to other laminates. The laminates were made with a standard grade phenolic resin and paper composed of 85% flake and 15% glassine pulp with a 50% resin pickup. The dielectric strength was nearly twice that of phenolic-paper and phenolic-cotton glass laminates and more than twice that of polyester glass-mat laminates. A table comparing property values of glass-flake laminates with other typical reinforced laminates is given.

Polyurethane rigid foams. R. Hurd. J. Refrigeration *1*, 59-62 (Mar./Apr. 1958). The production and properties of polyurethane rigid foams are described. Detailed information on density, compression, tension, thermal conductivity, fungus resistance, and heat resistance of these foams is presented.

Molding and fabricating

Testing thermosetting molding materials for moldability. J. T. Nye. Plastics Inst. Trans. *26*, 82-100 (Apr. 1958). Tests to evaluate the moldability of thermosetting plastics are discussed. These include pressure, rate of closing of press, dwell position and time, breathing time, tool characteristics, cure, hardness on extraction, flow, shrinkage, pelleting, specific gravity, resin content, filler content, and moisture content.

Radiation processing. T. Bain and W. H. T. Davison. Plastics Inst. Trans. *26*, 193-206 (Apr. 1958). Methods for irradiating plastics and some of the results produced are reviewed.

Polyethylene heat-seal factors. R. M. Knight, E. E. Froste, and W. U. Funk. Modern Packaging *31*, 152-56 (Apr. 1958). Many factors involving the heat-sealing properties of polyethylene film were studied. Machine variables included clamp time, sealing-bar

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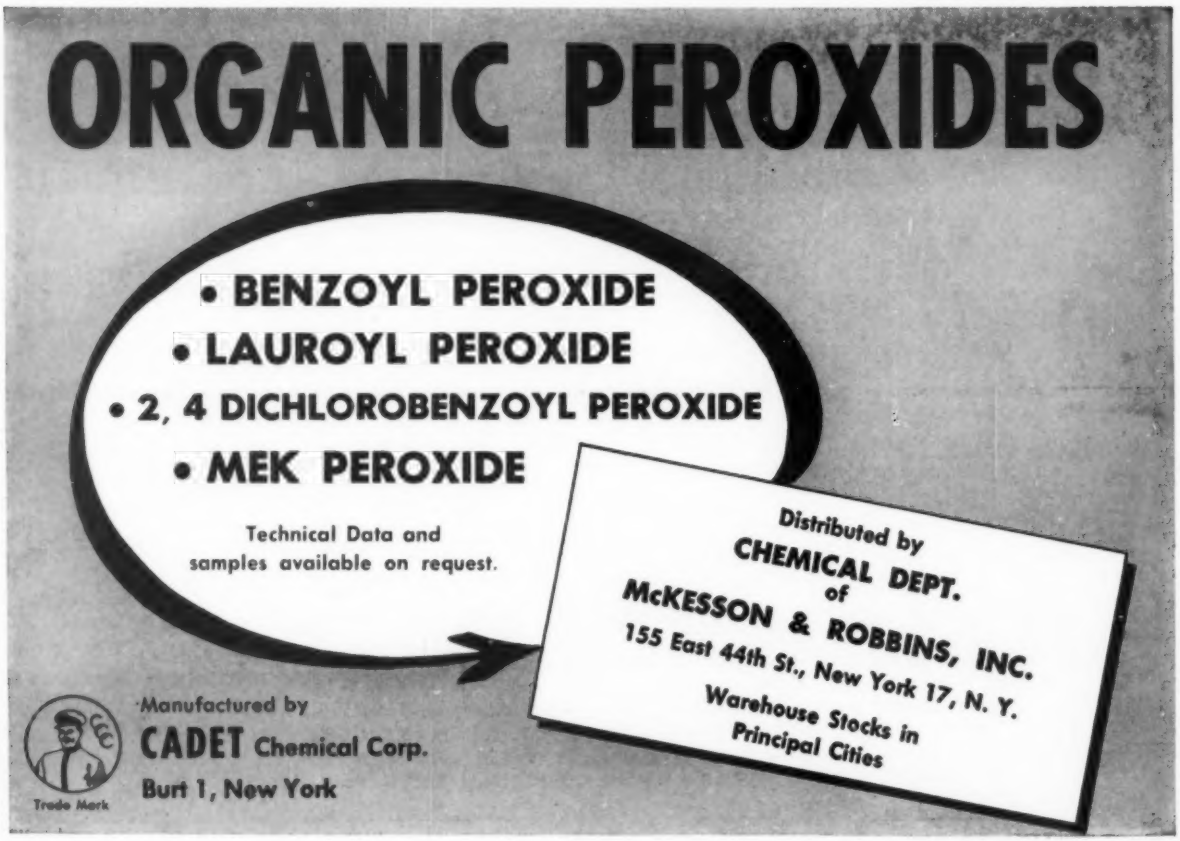
temperature, and pressure. Resin variables included density, melt index, and slip additives. Film factors included gage, style, and treatment for printing. Data were obtained over the temperature range of 250 to 500° F. using clamp times up to 5 sec., and pressures from 40 to 240 lb. per in. of seal. These data indicate that melt index, resin additives, and surface treatment generally cause no effect on operating conditions. Each of the other factors cause some influence on safe operating conditions. However, there appears to be a sufficiently wide range of machine variables to allow almost all types of film to be properly sealed.

Applications

Plastics in cars on the upswing. F. Giordano. Product Eng. *29*, 27-28 (Mar. 24, 1958). The use of plastic components in automobiles is increasing and 50 to 60 lb. of plastic are estimated in the 1965 car compared with the present 15 to 25 pounds. Glass reinforced molded phenolic gears are used by two automotive companies in automatic transmissions because of the ease of molding to strict tolerances, ability to withstand transmission oil temperatures up to 350° F., dimensional stability and desirable frictional properties. Steering column bushings, brake and clutch pedal suspensions and linkages, and king pin bushings of plastic are already in use. Plastic window mechanisms include rollers, window crank handle, and anti-rattle plates. Plastics are used on the piston rings and seals of power steering units. Fabrics and some car finishes are also made from plastic materials. A phenolic premix with a heat resistance between 300 and 400° F. with high impact strength, good water resistance, and low specific gravity is expected to be applicable to automobile manufacture. Other future applications of plastic components are also discussed.

Design of plastic towers. P. L. McWhorter. Chem. Eng. *65*, 164, 166, 168 (Apr. 7, 1958). Design characteristics of plastics towers are discussed. Sections should be designed with uniform thickness to offset unequal shrinkage. Sharp angles should be avoided to minimize part failure. Concentrations of material can be avoided by staggering cross-members or ribs. If sudden changes of form are avoided, molding strains will be reduced. Plastic towers are available in diameters from one to twelve feet and include packed, tube and plate types. The design and fabrication of towers of these types are described.

Polyethylene film for fruit. A. E. Hardenburg, H. A. Schomer, and M. Uota. Mod. Packaging *31*, 135-44, 197 (Feb. 1958). Extensive studies were made of the use of polyethylene box liners in the storage and preservation of fresh fruit. Proper packaging techniques, which use to advantage the permeability properties of polyethylene, may increase cold storage life by two or three times. A relatively constant level of oxygen, carbon dioxide, and water vapor is necessary to prevent



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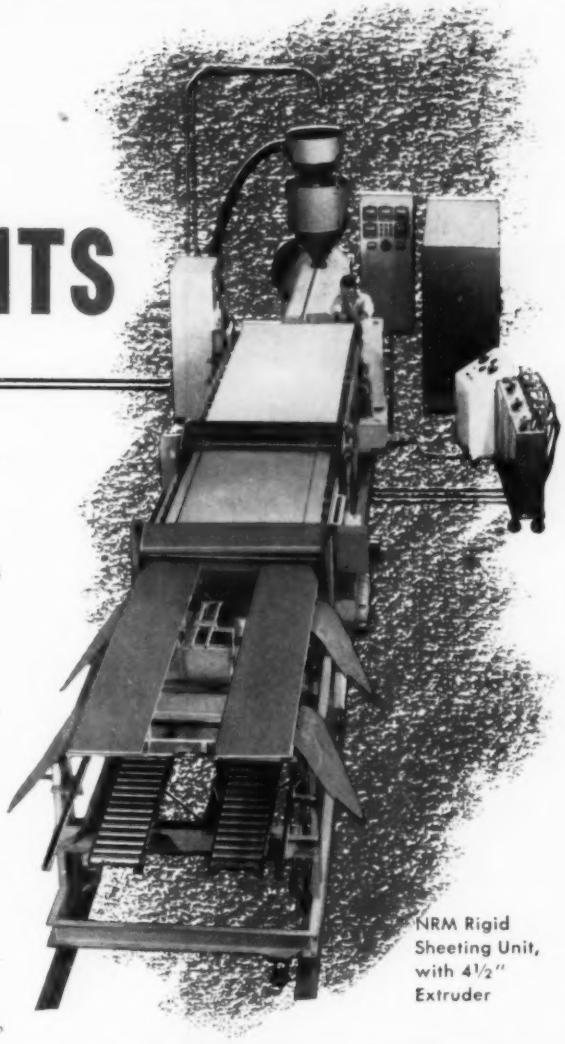

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Translucent plastic glazing in industry. The Plant *16*, 44-49 (Nov. 1957). Six applications of translucent fibrous glass reinforced polyester plastics glazing in plant construction are described.

Industrial protective clothing helps to reduce accidents. G. Baston. Machinery Lloyd *30*, 90-93 (Apr. 26, 1958). Protective clothing is made of rubber, polyvinyl chloride, nylon, polyester fibers, leather, wool, and asbestos. The advantages and disadvantages of each are discussed. The resistance of these materials to various industrial hazards are considered.

Plastic chain coupling eliminates lubrication. Design News *13*, 22-23 (Mar. 31, 1958). A 16-pitch nylon chain coupling of an electric motor to an oil circulating pump is described and illustrated. The advantages of nylon over metal chain couplings include longer wear, elimination of lubrication, and simplification of design.

Polyethylene overwrap film. R. Doyle and R. J. Martinovich. Mod. Packaging *31*, 215-20, 302, 304, 306 (May 1958). High-density polyethylene can be extruded and water-quenched to produce a light-gage film with the clarity and stiffness properties approaching that of cellophane packaging materials. The properties of this material are presented in detail and are compared to the properties of conventional poly-

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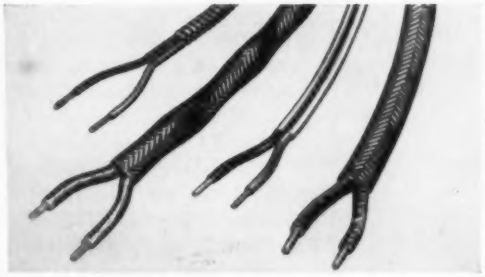

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ethylene and of cellophane. This material possesses certain characteristics which makes its use advantageous over many of the packaging materials now in use. The most serious problems involving the use of this material are a critical heat seal point, and the need for some modifications in existing overwrap packaging equipment.

Properties

Vapor transfer through barriers. K. Kammermeyer. Ind. Eng. Chem. *50*, 697-702 (Apr. 1958). The investigations of a number of workers in the field provide adequate data which permit a rather satisfactory correlation of vapor transport with adsorption characteristics. Thus, vapor transport can be analyzed for both plastic films and for microporous barriers. This would indicate that the correlation is generally applicable. Data on a total of 14 systems are available, covering water vapor, and inorganic and organic vapors in transport through barriers such as plastic films, paper, and silica and carbon powders. The powders in compressed form represent microporous barriers.

Irradiation effects in Plexiglas. B. Gross. J. Polymer Sci. 27, 135-43 (Jan. 1958). Samples of methylmethacrylate were irradiated with 2-m.e.v. electrons. Stopping and trapping of the incident electrons in the dielectric leads to the formation of a negative space charge. Under proper conditions the electric field of this charge can produce breakdown accompanied by the appearance of a characteristic discharge pattern. The nature of this effect is discussed. It is shown that the bulk of the space charge is concentrated in a narrow layer at a depth corresponding to the effective range of the electron beam. The quantity of charge released during breakdown is measured for various doses and compared with the value of the intercepted charge.

Commercial electrical insulating materials . . . Tables of properties. Part I. Insulation 4, 32-3 (Feb.); *Part II.* ibid. 32-3 (Mar.); *Part III.* ibid. 32-3 (Apr.); and *Part IV.* ibid. 30-1 (May 1958). The

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Testing

Measurement of PVC brittle point. H. O. Williams. Brit. Plastics *31*, 107-11 (Mar. 1958). A method of test and the apparatus used for the determination of the brittle point of vinyl chloride plastic film and vinyl chloride coated fabric are described in detail. The apparatus was designed for ease of temperature control and rapidity of test. Specimens are immersed in an ethanol-dry ice bath and impacted by a falling hammer. Two methods were developed for both the precise and approximate determination of the brittle point. The methods are compared and the relative precision of each is discussed. Data are presented to show the reproducibility and consistency of the tests, and the effects of thickness, plasticizer and filler content.

Publishers' addresses:

British Plastics: Iliffe and Sons, Ltd., Dorset House, Stamford St., London S.E. 1, England.

Chemical and Engineering News: American Chemical Society, 1155 Sixteenth St., N. W. Washington, D. C.

Chemical Engineering: McGraw-Hill Digest Publishing Co., Inc., 330 W. 42nd St., New York 36, N. Y.

Design News: Rogers Publishing Co., Englewood, Colo.

Electrical Manufacturing: The Gage Publishing Co., 1250 Sixth Ave., New York, N. Y.

Industrial and Engineering Chemistry: American Chemical Society, 1155 Sixteenth St., N. W. Washington 6, D. C.

Insulation: Lake Publishing Co., 718 Western Ave., Lake Forest, Ill.

Journal of Polymer Science: Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y.

Journal of Refrigeration: Foxlow Publications, Ltd., 19 Harcourt St., London, W. 1, England.

Machinery Lloyd: 6 Cavendish Place, Regent St., London W. 1, England.

Modern Packaging: Breskin Publications, Inc., 575 Madison Ave., New York 22, N. Y.

Plastics (London): Temple Press Ltd., Bowling Greene Lane, London E. C. 1, England.

Plastics Institute Transactions & Journal: The Plastics Institute, 6 Mandeville Place, London, W. 1, England.

Product Engineering: McGraw-Hill Publishing Co., 330 W. 42nd St., New York 36, N. Y.

Rubber and Plastics Age: Rubber and Technical Press, Ltd., Gaywood House, Great Peter St., London S. W. 1, England.

The Plant: The Plant Publishing Co., St. Joseph, Mich.

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U.S. Plastics Patents

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Resins. Y. Jen and S. T. Moore (to American Cyanamid). U. S. 2,834,675, May 13. Polyalkylene-polyamine resins.

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Blends. I. O. Saylor and J. A. Herbig (to Monsanto). U. S. 2,834,750, May 13. Blends of polystyrene and hydrogenated polymers of conjugated diolefins.

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Boats. R. E. W. Harrison, U. S. 2,834,971, May 20. Plastic boats.

Resins. J. M. Ward (to Haveg). U. S. 2,835,107, May 20. Rocket nozzle of inorganic-fiber-reinforced thermosetting resin.

Cellulose ether. R. W. Swinehart, M. A. Weaver, A. B. Savage, and B. V. Moeller (to Dow). U. S. 2,835,603, May 20. Water-soluble thermoplastic ethers.

Expansible pellet. S. Vernet and G. Asakawa (to Antioch College). U. S. 2,835,634, May 20. Thermally expansible polyethylene.

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Resins. W. C. Bauman and H. H. Roth (to Dow). U. S. 2,835,655, May 20. Water-soluble aromatic resin sulfonates.

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Plastic composition. A. D. F. Toy and K. H. Rattenbury (to Victor). U. S. 2,836,504, May 27. Plastic composition containing dialkyl monochlorophosphonate esters.

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(*To page* 163)

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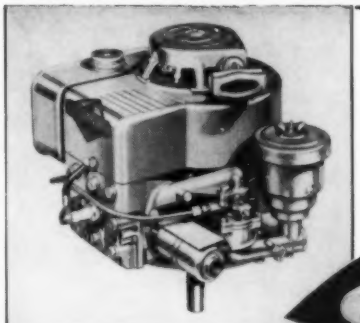

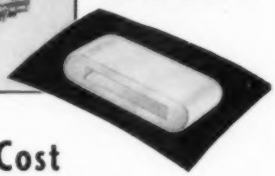

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Polymers. L. A. R. Hall (to Du Pont). U. S. 2,836,571, May 27. Producing p-methyl benzylchloride polymers by pyrolysis.

Cellular resins. L. Clark and A. C. Poshkus (to Armstrong Cork). U. S. 2,836,572, May 27. Vinyl resin containing polynitroso diurethane blowing agent.

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Stabilized composition. A. J. Kolka and G. G. Ecke (to Ethyl). U. S. 2,836,577, May 27. Stabilized hydrocarbon polymers.

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Copolymers. J. M. Hoyt (to Minnesota Mining). U. S. 2,836,582, May 27. Copolymers of trifluoroethylene and vinyl carboxylates.

Copolymers. G. H. Crawford, Jr. (to Minnesota Mining). U. S. 2,836,583, May 27. Copolymers of fluoroprene and trifluoromethyl-1,3-butadiene.

Polymerization. G. L. Wheelock and J. R. Smith (to B. F. Goodrich). U. S. 2,836,584, May 27. Suspension polymerization system.

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Laminate. T. R. Baxter (to Continental Can). U. S. 2,837,457, June 3. Laminated glass flakes.

Ion-exchange resins. A. F. Ferris (to Rohm & Haas). U. S. 2,837,488, June 3. Cation-exchange resins containing hydroxyl and phosphonic acid groups.

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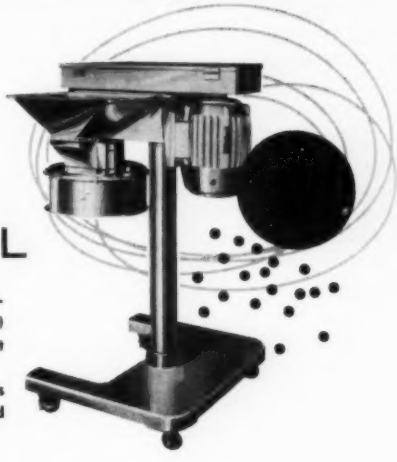

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Rotary compression press

An automatic rotary compression molding machine, originally designed by G-E engineers, is especially suited for the mass production of parts used in wiring devices and for small thermoset products. Two models are available, one having 10 stations, the other 30. Powder is hopper fed, finished parts drop through chutes into waiting tote boxes. Single- or multi-cavity molds may be used, and it is possible to make dozens of different parts on the press at the same time, providing molding compound is the same and cure times are about equal for all. Considerable versatility in temperature control is a valuable feature. Six to eight of these presses can be run by one operator. Specifications of both models are listed below. *New England Butt Co., 308 Pearl, Providence 7, R. I.*

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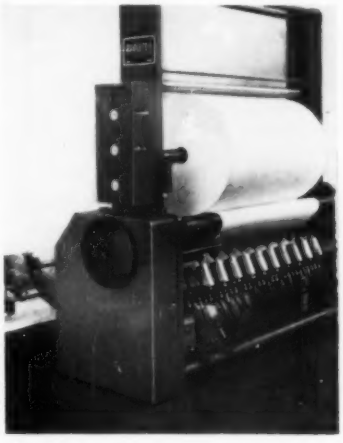
Specifications for New England Butt Co. automatic rotary compression molding machine.

Machine	*10-station press*	*30-station press*
Station capacity, tons	14	2.5
Hydraulic pressure, p.s.i.	1000	1000
Outside mold dimensions, in.	3.5 x 8	3.6 diam.
Mold cylinder stroke, in.	6	6
Maximum depth of mold, in.	1.75	1.38
Pump horsepower	15	7.5
Maximum curing time, min.	5	5
Minimum curing time, min.	1	1
Maximum demand of electric power, kw.	11.4	18
Air pressure required, p.s.i.	85	85
Floor space (press only), ft. diam.	7.5	6.8
Height, ft.	9.3	9
Shipping weight, tons	6	5

Winder/slitter

The Model SR-60 drum winder and slitter is capable of slitting most web materials into ribbons as narrow as ¼ inch. Web widths can range from 36 to 125 in., roll diameters up to 48 in. (60 in. with optional equipment). A new cutting principle makes it possible, even for inexperienced operators, to reassemble resharpened blades to a width tolerance of 1 mil. Cutters are air operated, can be adjusted to get equal pressure at all points. Control of roll tension is automatic. Machine is available with any type of electrical or mechanical drive. *Doven Div., Appleton Machine Co., Appleton, Wis.*



Appleton drum winder and slitter can slit materials as narrow as ¼ inch

Sheet forming machines

The new Erinac forming machines have many modern features, including facilities for pre-

*Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents. Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models and are subject to change without notice. The publishers and editors of MODERN PLASTICS do not warrant and do not assume any responsibility whatsoever for the correctness of the same, or otherwise.

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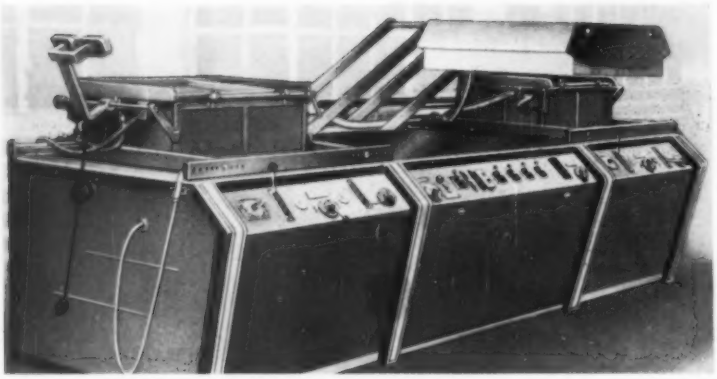


Erinac Type-N sheet thermoformer with two 40- by 40-in. platens. Single- and double-station models are available

stretching the heated sheet by air inflation. Several types are offered—single- and double-station models with heater bank swinging forward from the rear or from left to right. In the two-station models, the same bank alternately serves both stations. Maximum depth of draw on all the standard models is 10 in. (20 in. on special models). Six sizes are available with forming areas and heater wattages as follows: 24 by 20 in., 6 kw.; 30 by 24, 8.5; 40 by 40, 20; 51 by 40, 25; 59 by 40, 30; and 71 by 40, 34. The various models are offered as semi-automatic machines or with fully automatic cycle controller. These German-built machines are sold and serviced in the U. S. by *Erinac Equipment Corp., 225 Lafayette St., New York 12, N. Y.*

RP sprayup equipment

A line of portable sprayup equipment for epoxy, polyester, and other reinforced molding consists of a two-nozzle gun that sprays promoted and catalyzed resin streams to a focal point then onto mold surfaces, plus a separate unit that chops and sprays glass roving onto resin-wetted surface. Glass must be rolled into resin layer for good impregnation. Used together, the two devices are claimed to make substantial savings in labor and glass costs in molding such items as boats (see "Reinforced plastics by 'sprayup,'" M. PL. Feb., 1958, p. 119). Resin gun can deposit up to 6 lb./min. glass gun, up to 4 lb./minute. A complete outfit, including feed equipment and training course, costs about $2500. *Hupp Engineering Associates, P. O. Box 3290, Sarasota, Fla.*

Heating blankets

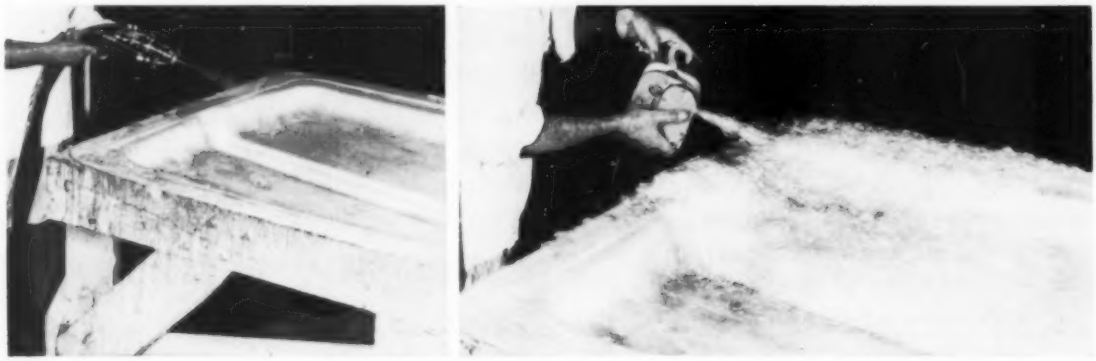
Briskeat heating blankets are essentially heating tapes bonded together. These tapes consist of heating elements embedded in silicone rubber (see this department June 1957). Maximum temperatures are 450° F. for continuous duty, 600° F. for intermittent use. Blankets are fabricated to customer's requirements, with considerable latitude in size, watt density, and output. *Briscoe Mfg. Co., 1055 Gibbard Ave., Columbus 3, Ohio.*

Beside-the-press granulators

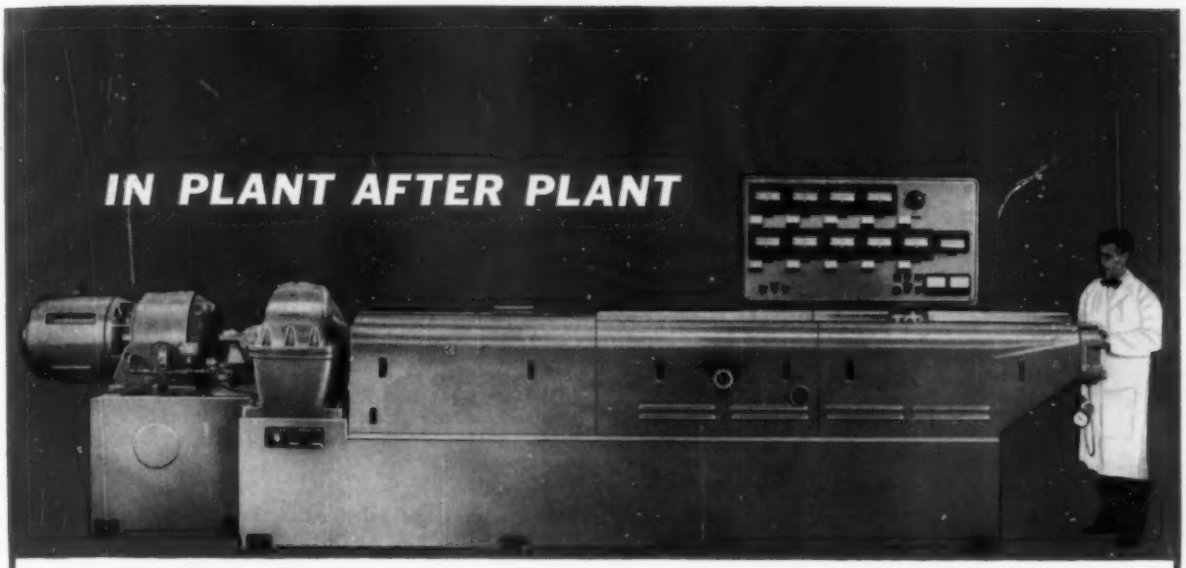
Five granulating machines feature larger throat openings and less floor-space requirement than their predecessors; openings range from 7 by 10 in. to 12 by 20 inches. All models have new knife design and slower rotor speeds than older models, leading to cleaner cutting and quieter operation. These new models are said to perform well on all thermoplastics from the softest to the hardest. Other features: welded construction; ready accessibility of working parts. *Cumberland Engineering Co., Box 216 Providence, R. I.*

6/9-oz. injection machine

The Model 2414-6 injection machine is rated for 6 oz. of GP polystyrene per shot without prepacking, 9 oz. with. Top plunger speed is 5.3 in./sec.; dry-cycle time (min.) is 4 seconds. The clamping linkage is of the horizontal toggle type, stroke is adjustable from 6 to 14 in., and molds up to 14.8 by 28 in. can be handled. Maximum daylight opening is 32 inches. Standard features include: separate booster and holding pressure controls, plunger prepositioning and stuffing controls, and of course, ad-



Hupp-dual-nozzle, non-clogging gun (left) for applying catalyzed and promoted polyester resins simultaneously to a contact mold. Roving glass breaker (right) is used to apply short filaments broken from glass roving to a layer of polyester resin



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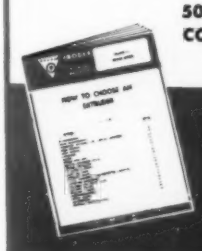

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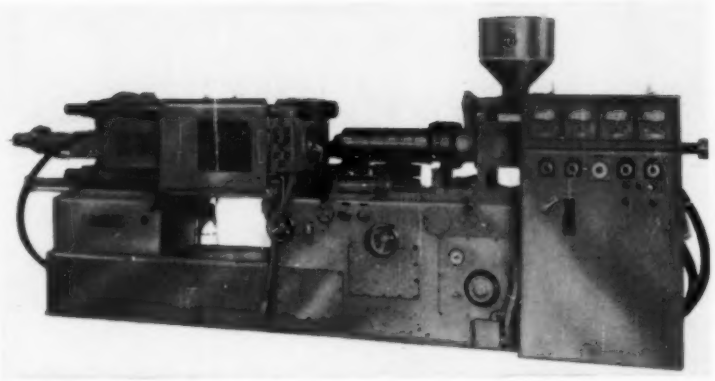


Lombard 2414-6 injection machine is rated for 6 oz. of GP polystyrene per shot without prepacking; 9 oz. with prepacking

justable injection speed, clamping speed, and locking pressure. Hydraulic system is based on two vane-type pumps. General characteristics are the same as the larger presses first offered in 1955. *Lombard Governor Corp., Ashland, Mass.*

Granulator-blender-loader

The Model BL is a combination injection molding accessory that regrinds scrap, blends it with virgin material, and conveys the mix to the molding machine hopper. The granulator part has a 4.5-by 9-in. throat, four knives, standard ¼-in. screen, and is driven by a 1.5-hp. motor. No compressed air is used in this device. *Thoreson-McCosh, Inc., 18208 W. McNichols Rd., Detroit 19, Mich.*

Simple gunk pre-mix mixer

Small amounts of two-component resin systems must often be mixed well just before they are used. The Gyro plastic mixer, a simple rotor that can be chucked into any portable drill, was designed especially to do this job. Blending is accomplished in half or one-third the time it takes by hand with a paint paddle or the like, and the intimacy of mixing is better. The mixer will mix any volume from a pint to a gallon without splashing the mix out of the container. *Plaster Supply House, P. O. Box 551, Chicago, Ill.*

Small vertical extruder

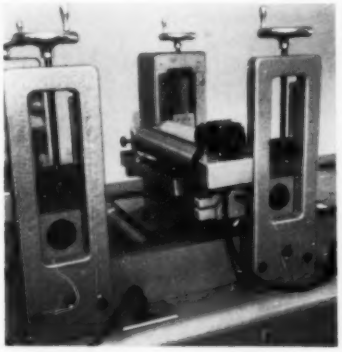
Designed especially to facilitate two-color extrusion, the Model 1250-A is a 1.25-in.-diameter vertical extruder mounted adjustably on a vertical shaft. This mounting makes the extruder easy to tie in with any existing equipment, so that two machines can supply different colors to a single die. Cylinder is one piece, alloy steel, chrome plated; screw likewise; L/D ratio is 10. Temperature control of 1200-w. heater is achieved with voltage regulator and thermometer. Screw is powered by ¾-hp. variable-speed drive that gives speeds ranging from 7 to 55 r.p.m.;

Thermoplastic Model 1250-A is a 1.25-in.-diameter vertical extruder mounted on a vertical shaft

a single wing bolt releases the barrel for cleaning, a single set screw releases the screw; machine can be taken down in a few minutes. *Thermoplastic Processes, Inc., Stirling, N. J.*

Flexographic printer

New Cosomatic flexographic printer is similar in many respects to the maker's letter-press printer described here in Sept., 1957, p. 200. Principal differences are: gear-driven printing towers assure accurate registration; new press can use flexographic inks. Both can print flat, round, tapered, raised, or recessed articles, on three different levels in three colors. Cylindrical surfaces up to 18 in. in diameter can be printed. *Cosom Engineering Corp., 6012 Wayzata, Minneapolis 16, Minn.*



Cosom flexographic printer has gear-driven printing towers

Insert inserter

A threaded-insert machine has been developed to insert Dodge knurled and tapered, threaded inserts into drilled or molded holes. A single-punch machine will install up to 72 inserts per minute. Where more than one insert is used in a single piece, the machine can be tooled to place and expand as many as six inserts at a time. Basically the machine consists of a feed hopper, an orienting unit, and an air cylinder. With small parts, complete automation is possible, and quality is more consistent than with hand insertion. Price is $1150; or rental is $100/mo. plus transportation. *Phelps Mfg. Co., P. O. Box 542, Westport, Conn.*

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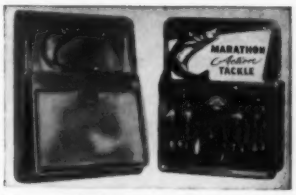

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Books &

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A Guide to Plastics, 2nd Ed.

By C. A. Redfarn

Published in 1958 by Philosophical Library, 15 E. 40th St., New York, N. Y. 150 pages. Price: $7.50.

After a short introductory chapter on definitions and nomenclature in the plastics field, the author lists the raw materials for plastics, telling where they in turn come from. A long chapter discusses the manufacture of plastics materials, without going into the chemistry of the processes. Beautiful multi-color charts that clearly show the sequence of operations in each major manufacturing process are alone worth the price. Also included is a good introduction to plastics fabrication and processing and a little information on properties.—*J.F.C.*

"Fundamentals of High Polymers"

By O. A. Battista

Published in 1958 by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 140 pages. Price: $5.50.

The author says he hopes this book should serve not only as an undergraduate text but also to familiarize people new in the high-polymers industries with the fundamentals of the field. The author presumes almost no knowledge of chemistry on the part of the reader, begins with clear definitions of technical terms concerning high polymers, uses complete structural formulas throughout the book. It is especially well suited to the needs of those who have not studied organic chemistry or have forgotten it. In the first half of the book, the chemical make-up of all the important natural and synthetic polymers is covered. In the second half are chapters on crystallinity and chain packing, behavior of polymers in solution, and measurement of crystallite size and distribution. A short chapter on physical properties is too short. A selected bibliography includes the best books available on the subject.—*J.F.C.*

"Plastic embedding and laminating C.M.E.—D Series Polyester Resin"

By Earnest L. Lutz, Sr.

Published in 1958 by Natcol Laboratories, Route 2, Box 575, Redlands, Calif. 105 pages, 36 illustrations. Price: $3.50

This book covers the preparation and embedding of dry, inert materials and all types of biological specimens. New resin formulations are given that permit mounting of undried specimens, something heretofore impossible with anything larger than microsections. Preparation and embedding of all kinds of things are covered in detail, with particular attention to the difficult biological field. Clear and very complete.

Impregnating compound. Properties, processes, applications, biological effects, etc. of Monovinylcarbazol available from Badische Anilin-& Soda-Fabrik AG., Ludwigshafen, Germany, for the impregnation of condensers and other electrical components. In German. 4 pages. *BASF, Inc., 375 Park Ave., New York 22, N. Y.*

Buying and Selling Plastics. Sections deal with definition of plastics; how plastics are made into goods; how to judge the quality of plastic goods; and the A.B.C. of plastics. 14 pages. *Imperial Chemical Industries, Ltd., Plastics Div., Black Fan Rd., Welwyn Garden City, Herts, England.*

Colored molding materials. "Durez Polyester Colors" gives physical properties, compression molding pressures, closed mold technique pressures, mold temperature, curing time, shelf life, applications, etc. for these thermosetting molding compounds. 8 pages. *Durez Plastics Div., Hooker Chemical Corp., N. Tonowanda, N. Y.*

PVC pipe. Chemical resistance, working temperatures, flow efficiency, specifications, etc., for Jal-Jacket PVC pipe. 4 pages. *Jones & Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 30, Pa.*

Silicones. Data on major G-E silicone products and their uses in the aircraft, electrical, automotive, textile, chemical, paint, and other industries. 8 pages. *General Electric Co., Silicone Products Dept., Waterford, N. Y.*

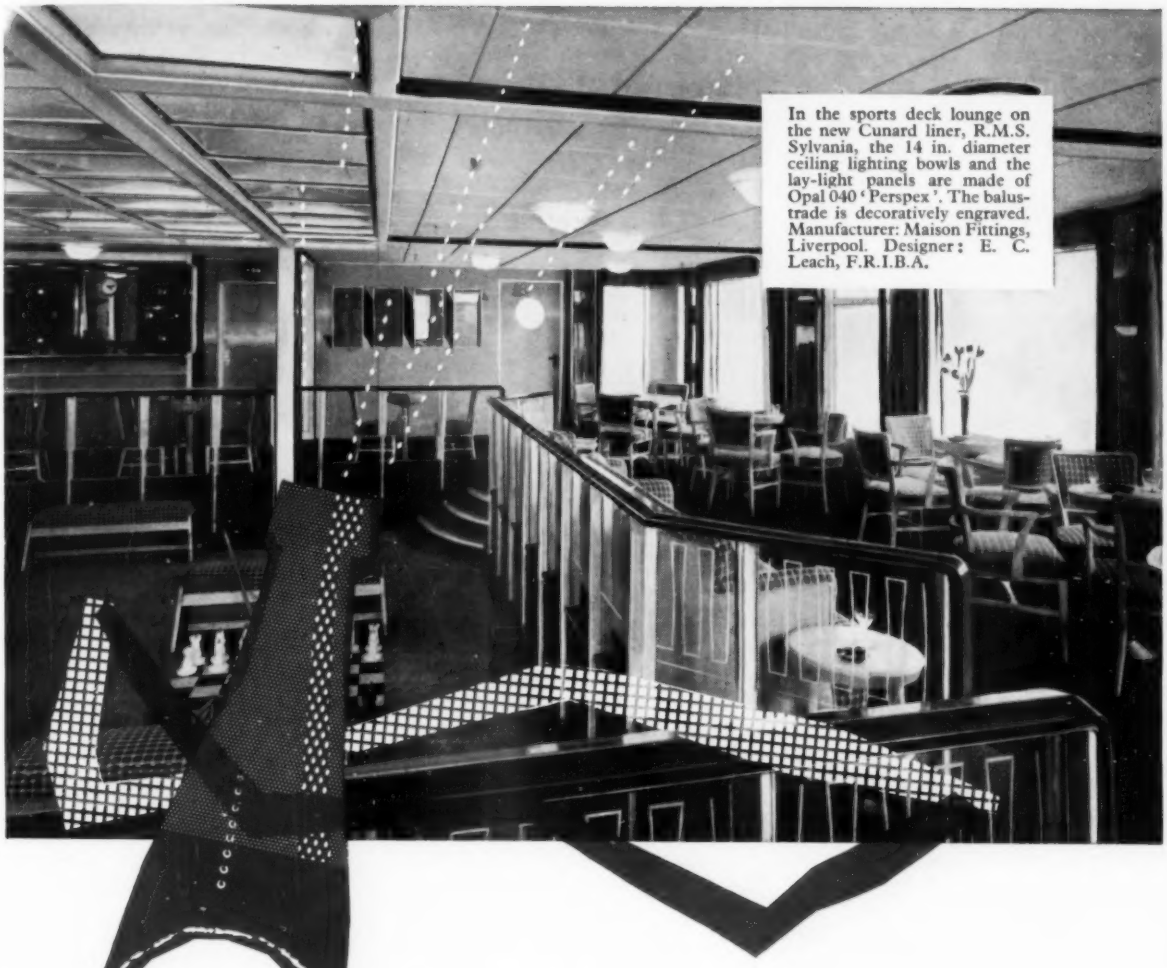
Methanol. Applications, physical properties, and specifications for methanol, a chemical used to manufacture formaldehyde, solvents, denaturants, etc. 4 pages. *Chemical Div., Reichhold Chemicals, Inc., 525 N. Broadway, White Plains, N. Y.*

Marking machines. Functions and specifications of five different offset printing units for plastics and other industrial printing applications. 8 pages. *Jas. H. Matthews & Co., 3951 Forbes St., Pittsburgh 13, Pa.*

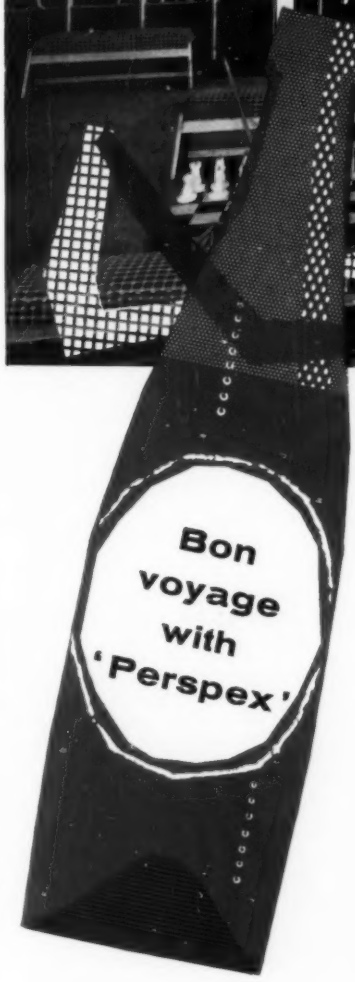
Corrugated boxes. Discusses conventional types of corrugated board, seven basic box styles, and 60 corrugated packing devices. "How to Specify Corrugated Boxes." 34 pages. *Hinde & Dauch, Sandusky, Ohio.*

Polystyrene. Photographs and descriptions of applications for polystyrene foam plastics products, including properties and characteristics of Styrofoam and Dylite. 4 pages. *Customer Service Div., Glo-Brite Products, Inc., 6415 N. California Ave., Chicago, Ill.*

Epoxy cements. Uses, available quantities, etc. for epoxy cements, used in applications ranging from repair of defects in patterns to caulking joints and seams in sheet metal. Includes data on iron



In the sports deck lounge on the new Cunard liner, R.M.S. Sylvania, the 14 in. diameter ceiling lighting bowls and the lay-light panels are made of Opal 040 'Perspex'. The balustrade is decoratively engraved. Manufacturer: Maison Fittings, Liverpool. Designer: E. C. Leach, F.R.I.B.A.



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cements and epoxy resin repair kit. 4 pages. *Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City 4, N. J.*

Nylon. "The Dielectric Properties of Nylon." Report on investigations over frequencies from 60 to 36×10^9 cycles and over a temperature range of −80 to +170° C. 20 pages. Price: 10/6d. $1.50. *The British Electrical and Allied Industries Research Assn., Thorncroft Manor, Dorking Rd., Leatherhead, Surrey, England.*

Heating units. Technical data on cartridge and ceramic heating units for heat sealing, injection machines, packaging machinery, and other uses. 12 pages. *Hotwatt, Inc., 16 Gould St., Danvers, Mass.*

Ovens, dryers, and heaters. Data on ovens, dryers, and heaters to produce "engineered atmospheres" for curing plastics, rubber, and ceramics; baking cores; drying can linings; etc. Bulletin S-4. 8 pages. *J. O. Ross Engineering Corp., 444 Madison Ave., New York, N. Y.*

Production facilities. "Development and Progress" describes facilities available for designing and producing injection molded plastics parts. 12 pages. *Lincoln Molded Plastics, Inc., Circleville, Ohio.*

Polyethylene packaging. Properties, uses, etc. of polyethylene in coatings, films, and moldings, including its marketing appeal; protection of products; reduction of packaging, handling, and selling costs, etc. 16 pages. *U. S. Industrial Chemicals Co., 99 Park Ave., New York 16, N. Y.*

Plastics production. "The Fabricated Plastics Products Industry in Puerto Rico." A plant survey. 7 pages. *Economic Development Administration, Commonwealth of Puerto Rico, 666 Fifth Ave., New York 19, N. Y.*

Aliphatic chemicals. Test data on ADM's olefins hydrocarbons, etc., including solubility, compatibility, physical constants charts, and gas chromatographic composition data. Bulletin 911. 52 pages. *Chemical Products Div., Archer-Daniels-Midland Co., Box 839, Minneapolis 40, Minn.*

Copper-clad laminates. Physical, mechanical, and electrical properties of four grades of copper-clad plastic laminates for electronic printed circuits. Data Sheet No. 8-1. 4 pages. *Taylor Fibre Co., Norristown, Pa.*

Hydraulic cylinders. Technical data on hydraulic power cylinders, including factors to consider in selecting cylinders, etc. Bulletin JH-104N (Supersedes Bulletin H-104K). 32 pages. *Miller Fluid Power Div., Flick-Reedy Corp., 2040 N. Hawthorne Ave., Melrose Park, Ill.*

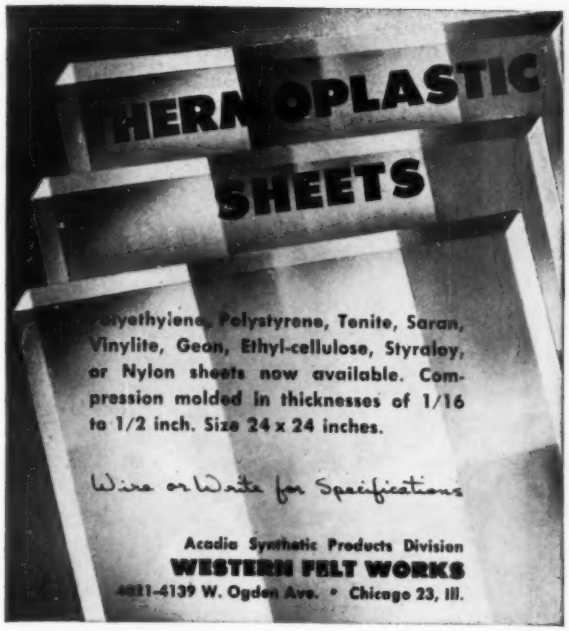
Prepreg materials. Technical data on a comprehensive line of preimpregnated fabrics and papers for laminating and molding. Carrying the trade name Polyplastex Prepreg, various reinforcing media are available, impregnated with epoxy, polyester, silicone, phenolic, diallyl phthalate, and melamine resins. Physical and electrical properties, fabrication information, curing conditions, etc., are given for epoxy- and polyester-impregnated glass fabrics. Data on other materials on request. 24 pages. *Polyplastex United, Inc., 870 Springfield Rd., Union, N. J.*

New Shapes in Plastics. Products produced by vacuum, vacuum snap-back, drape, and stretch forming. 4 pages. *Delta Products, 1400 Henderson, Ft. Worth, Tex.*

Sealants, adhesives, and pastes. Comparison chart, applications, colors, etc. for sealants, adhesives, and pastes from furanes, epoxies, and polyurethanes. 4 pages. *Furane Plastics, Inc., 4516 Brazil, Los Angeles, Calif.*

TFE resins. Equipment and techniques required in machining Teflon plastic to close tolerances. 10 pages. *Tri-Point Plastics, Inc., 175 I.U. Willets Rd., Albertson, N. Y.*

Crotonic acid. Properties, reactions, and applications for crotonic acid, an intermediate in the formation of molding polymers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We have available for immediate sale 50,000 lbs. of virgin mixed colors, suitable for plating or other applications, and several thousand pounds each of virgin offstandard colors in pellets, such as red, green, blue, etc. Also, 5000 lbs. of reground translucent white.

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We are equipped to custom reprocess your nylon scrap and return it pelletized, vacuum dried, in metal cans.

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and co-polymers, plasticizers, etc. 10 pages. Bulletin TDR #A-101. *Eastman Chemical Products, Inc., Kingsport, Tenn.*

Resin solvent; allyl esters. Physical properties, chemical reactions, applications, toxicity, etc. of dimethyl acetamide. 4 pages. Similar data for a line of allyl esters. 4 pages. *Monomer-Polymer Laboratories, The Borden Chemical Co., 5000 Langdon St., Philadelphia 24, Pa.*

Plastics pipe. Advantages, applications, etc. of a line of polyethylene, Kralastic, butyrate, PVC, and Chem-weld drainage, well casing and conduit pipe. 4 pages. *Southwestern Plastic Pipe Co., P. O. Box 117, Mineral Wells, Texas.*

Dip coatings. "Isogel 151. 100% Epoxy Dip Coating Compound Curing at Moderate Temperature" includes storage stability and working life, application methods, curing schedules, etc. 7 pages. "Isogel 131. Thixotropic Polyester Dipping Compound" gives typical properties, preparation of dipping compound, application methods, etc. 4 pages. *Isochem Resins Corp., 221 Oak St., Providence 9, R. I.*

Wire gage. "Automatic Control of Diameter with the Microlimit Control Wire Gauge for Thermoplastic and Rubber Insulated Wire, Extruded Tubing, Rods, Shapes, Filaments, and Special Wires" gives specifications, equipment and services, etc. 4 pages. *Industrial Gauges Corp., West Englewood, N. J.*

Thermoplastic sheets. Descriptions, applications, etc. for Seilon rigid thermoplastic sheets for automotive, aircraft, construction, electrical, and chemical industries. 8 pages. *Plastics Div., Seiberling Rubber Co., Newcomerstown, Ohio.*

Plastic Steel. Description, applications, physical properties, chemical resistance table, etc. of Plastic Steel and other Devcon products for making jigs, molds, models, fixtures, etc. Bulletin N1-103. 12 pages. *Devcon Corp., Danvers, Mass.*

Spray guns. Models, specifications, applications, etc. for a line of manual, automatic, and special purpose spray guns. Catalog 1-2000. 16 pages. *The DeVilbiss Co., 296 Phillips Ave., Toledo 1, Ohio.*

Polyethylene blends. "Properties of Pieces Injection Molded from Mixtures of Dylan Polyethylene and Super Dylan Polyethylene Pellets" includes technical data on density, melt index, stiffness, tensile yield, etc. 4 pages. *Plastic Div., Koppers Co., Inc., Pittsburgh 19, Pa.*

Adhesives, coatings, and sealers. List of U. S. government specifications for a variety of adhesives, coatings, and sealers, and the corresponding 3M products. Catalog 8. 26 pages. *Adhesives, Coatings & Sealers Div., Minnesota Mining & Mfg. Co., 423 Piquette Ave., Detroit 2, Mich.*

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The versatility of WILLIAMS-WHITE design and construction is well represented in the 200 Ton Hydraulic Press as shown, installed in one of the nation's leading aircraft plants.

The press was purchased for such diversified operations as fibreglass molding, metal bonding, production of honeycomb sections and other compression molding operations. The accuracy and selectivity of control permits the press to be used in either production or laboratory projects.

Steel plates, heated by steam and cooled by water, are mounted on the face of the table and slide.

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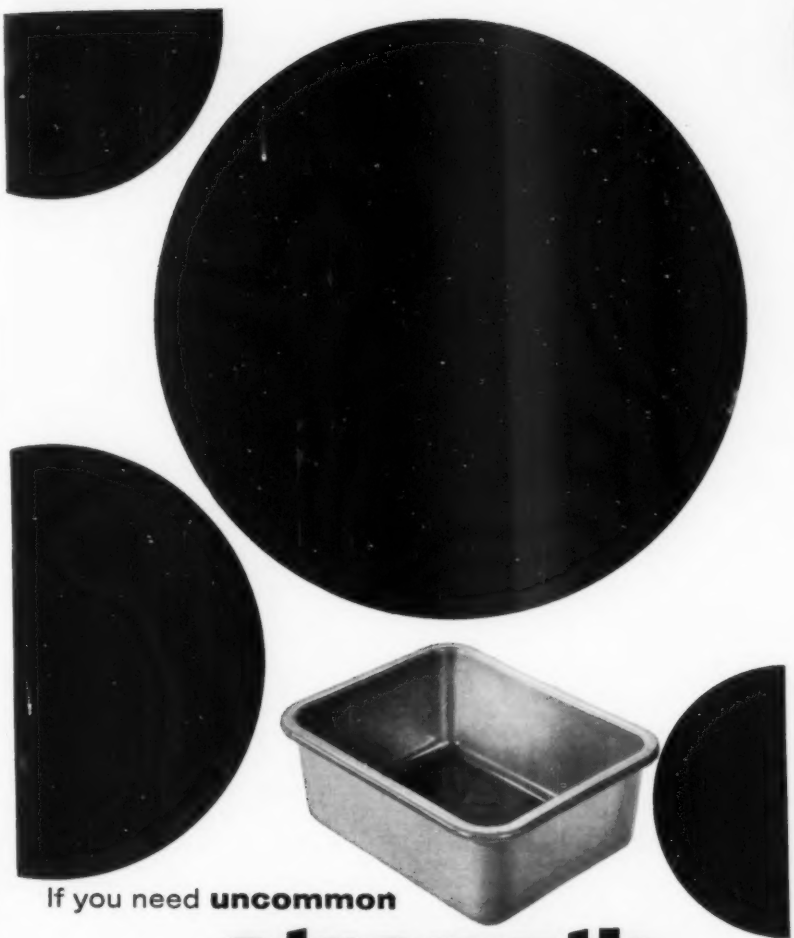

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GREX* in action

That dishpan on the left was molded from GREX high density polyethylene by an important new process . . . a Pre-Compressed Molding process which gives highly superior products, substantial dollar savings, and greater economy of operation.

Pre-Compressed Molding

In this new molding process, the gates contain valves that are closed as the injection takes place, and the material in the heating chamber, runners and sprues is compressed to the maximum pressure for molding. At optimum pressure, the valves are automatically opened and the plastic material pours into the cavity at high velocity. The valves are then closed and the finished part is ejected without sprues or gates—another plus feature. Multiple or single cavity molds may be valve-gated as well as individual runners in molds with an unusually large number of cavities.

It makes possible bigger, deeper molds and produces strain-free moldings with greatly improved physical properties, particularly in impact strength. Parts are freer from stresses, poor welds, trapped air and cracks . . . surface finish on parts noticeably improved.

Scrap losses are decreased. Because no gates or sprues need be trimmed, finishing cost are reduced. With lower machine temperature, warpage, material breakdown, shrinkage marks and color variations are virtually eliminated for all thermoplastic materials.

Since GREX high density polyethylene is suitable for elevated temperature applications and can be boiled and sterilized, it is particularly important that moldings be strain free and warpage be minimized. This new process almost invariably reduces molding cycle time for GREX and other thermoplastics—usually one-half to two thirds!

Putting this Process to Work for You

GRACE's Polymer Chemicals Division has been licensed exclusively under patents held by Columbus Plastic Products, Inc., Columbus, Ohio, and in turn GRACE will sub-license plastic molders so that the benefits of this new process may be made widely available.

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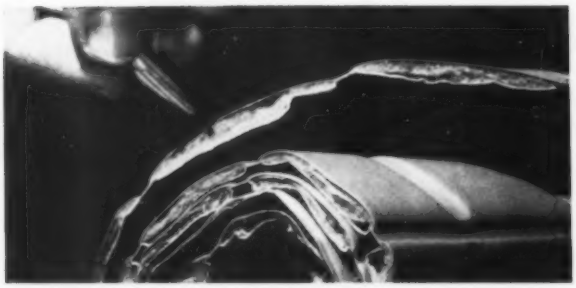

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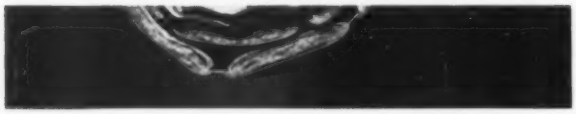

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Can use almost any cardable fiber or combination • Vary resin content from 15-45% • Thickness from 1/16" to 1", specialties to 2" • Weight from 4 oz. to 16 oz. and up • Width from 16" to 80" but 72" preferred • Color within mix limits, natural shades

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mp Plastics

Production and sales figures in 1000 lb.* for April and May 1958

Materials	*Total p'd'n first 5 mos. of 1958‡*	*Total sales first 5 mos. of 1958‡*
Cellulose plastics:[a]		
Cellulose acetate and mixed ester:		
Sheet, under 0.003 gage	6,819	6,783
Sheet, 0.003 gage and over	7,774	6,747
All other sheets, rods, tubes	3,432	3,134
Molding, extrusion materials	33,112	32,811
Nitrocellulose sheets, rods, tubes	1,391	1,515
Other cellulose plastics	3,825	2,712
Phenolic and other tar-acid resins:		
Molding materials[a]	65,607	60,684
Bonding and adhesive resins for:		
Laminating (except plywood)	23,669	15,445
Coated and bonded abrasives		
Friction materials (brake linings, clutch facings, etc.)	4,786	4,097
Thermal insulation	18,528	17,855
Plywood	19,573	16,501
All other bonding uses	15,145	14,980
Protective coating resins	11,631	9,601
Resins for all other uses	11,556	8,634
Urea and melamine resins:		
Textile-treating resins	14,112	13,170
Paper-treating resins	10,602	8,722
Bonding and adhesive resins for:		
Plywood	34,894	36,404
All other bonding and adhesive uses, including laminating	16,789	14,656
Protective-coating resins	11,288	8,933
Resins for all other uses, including molding	40,455	37,073
Styrene resins:		
Molding materials[a]	163,771	181,574
Protective-coating resins	36,682	36,037
Resins for all other uses	62,856	50,885
Vinyl resins, total[b]	301,226	294,766
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride for:		
Film (resin content)		29,537
Sheeting (resin content)		22,476
Molding and extrusion (resin content)		77,271
Textile and paper treating and coating (resin content)		21,016
Flooring (resin content)		44,168
Protective coatings (resin content)		12,039
All other uses (resin content)		22,006
All other vinyl resins for:		
Adhesives (resin content)		18,399
All other uses (resin content)		48,124
Coumarone-indene and petroleum polymer resins:	94,106	93,051
Polyester resins:		
For reinforced plastics	40,728	37,142
For all other uses	4,186	3,997
Polyethylene resins total:	342,220	310,890
For film		126,570
For all other uses		184,240
Miscellaneous:		
Molding materials[a, d]	15,098	15,660
Protective-coating resins[e]	5,062	3,144
Resins for all other uses[f]	59,140	50,080

*Dry basis designated unless otherwise specified. †Revised.
‡Partially estimated.
[a]Includes fillers, plasticizers, and extenders. [b]Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production

Production

From statistics compiled by the U. S. Tariff Commission

April†		May‡	
Production	*Sales*	*Production*	*Sales*
1,276	1,275	1,344	1,381
1,778	1,410	1,536	1,432
699	591	721	590
6,452	6,093	6,192	6,365
229	275	246	271
775	512	769	503
10,728	11,515	11,726	11,451
4,473	2,651	4,129	2,763
1,055	842	818	813
767	743	847	636
3,845	3,459	3,960	4,329
4,022	3,784	4,061	3,319
2,836	2,888	2,435	2,452
2,353	1,938	2,085	1,991
1,677	1,410	2,246	1,829
2,732	2,425	2,559	2,344
2,154	1,757	1,812	1,668
6,416	7,149	7,204	7,886
3,323	2,873	3,743	2,580
2,063	1,799	2,225	1,834
7,612	6,623	7,894	6,805
†36,260	37,646	36,372	42,556
6,744	7,408	7,298	4,497
12,098	10,286	12,142	9,706
†54,436	†59,866	56,788	62,798
	5,424		5,811
	4,643		5,054
	15,705		15,958
	3,881		4,769
	9,079		10,347
	†2,064		2,518
	5,287		5,519
	4,087		3,674
	9,696		9,419
20,066	18,815	18,881	19,209
9,221	8,671	9,913	9,051
745	830	956	989
66,813	69,186	70,963	61,584
	26,558		23,670
	42,628		37,914
2,616	2,924	3,221	3,227
956	723	1,160	714
12,697	10,983	12,612	10,810

are given. †Includes data for spreader and calendering-type resins. ‡Includes data for acrylic, nylon, and other molding materials. §Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. ‖Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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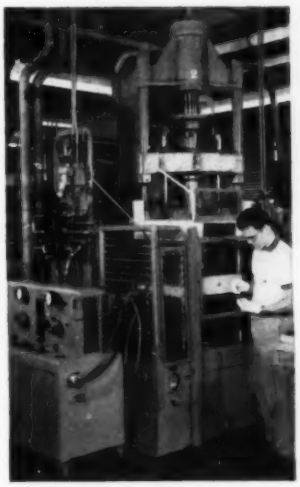

The Apparatus and Optical Division of the Eastman Kodak Company uses one of its Sterlco Model 6002 units on the injection press in which the back of the popular new Kodak Rotary Flasholder is molded. Use of the Sterlco Control enables the operator to make very accurate temperature adjustments, and to control independently the temperature of each section of the mold.

For YOUR mold temperature control needs, choose from the following Sterlco units:

MODEL 6002

MODEL 6012

MODEL 6031

MODEL 6003

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Color, APHA	25 max.
Odor	Neutral
Specific Gravity, 20/20°C	0.936 ± 0.003
Free acidity, as acetic acid	0.01% max.
Ester Content	99.0% min.

Other Uses—
Vinyl chloride resins, copolymers and plastisols, safety glass and safety plastic interlayers, cellulose acetobutyrate, neoprene and acrylonitrile-butadiene copolymer low temperature formulations, rubber hydrochloride films.

Dicapryl Phthalate

FDA Accepted for foods of high water content only

Appearance	Clear liquid
Color, APHA	50 max.
Odor	Faint
Specific Gravity, 20/20°C	0.972 ± 0.003
Free acidity, as acetic acid	0.01% max.
Ester content	99.0% min.

Other Uses—
Vinyl chloride resins, copolymers and plastisols, nitrocellulose, ethylcellulose, acrylates, natural and synthetic rubbers and polyvinyl butyral.

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PACKAGING EQUIPMENT. 64-page condensed catalog pictures and describes lines of electric vibrators, dry feeder machines, weighing equipment, vibratory parts feeders, and other materials handling equipment. Includes specifications, list of sales agents. Syntron Co. **(I-803)**

SPRAY GUN FOR REINFORCED PLASTICS. Booklet presents spray gun-like tool that cuts glass rovings into desired lengths and then applies it, together with mixed resin, catalyst and promoter, to mold. Deposition table included. Rand Development Corp. **(I-804)**

PLASTISOL STABILIZERS. Two 2-page leaflets describe recommended applications, usages and physical properties of two new liquid stabilizers for plastisols: barium-zinc and cadmium-barium-zinc. Ferro Chemical Corp. **(I-805)**

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PVC MOLDING COMPOUNDS. Illustrated 12-page booklet describes properties, conversion, application methods, uses of "Chem-o-sol" liquid coating and molding compounds. Predicts new "Chem-o-sol" uses; presents services. Chemical Products Corp. **(I-807)**

ACRYLIC MOLDING POWDER. Illustrated 8-page booklet describes properties of grades of a modified acrylic high-impact powder for injection molding and extrusion of sheets, rods, and tubes. Includes technical data, fabricating techniques, applications. Rohm & Haas Co. **(I-808)**

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INJECTION MOLDING MACHINES. Literature illustrates and describes line of two, three, and four-ounce hydraulic injection machines with plasticizing capacities ranging from 50 to 90 lbs. per hour. Specifications included. Moslo Machinery Co. **(I-810)**

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CUSTOM PLASTIC PRODUCTION. Illustrated 30-page brochure discusses plastics materials, design concepts, fabricating processes, applications. Presents this company's available plastics production facilities, and development and manufacturing services. Goodyear Aircraft Corp. **(I-815)**

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RUBBERIZED ABRASIVES. Illustrated 8-page industrial catalog describes a line of rubberized abrasive wheels, points, blocks, sticks, and cones for deburring, smoothing, polishing, cleaning. Includes dimensions, applications, price list. Cratex Mfg. Co. **(I-818)**

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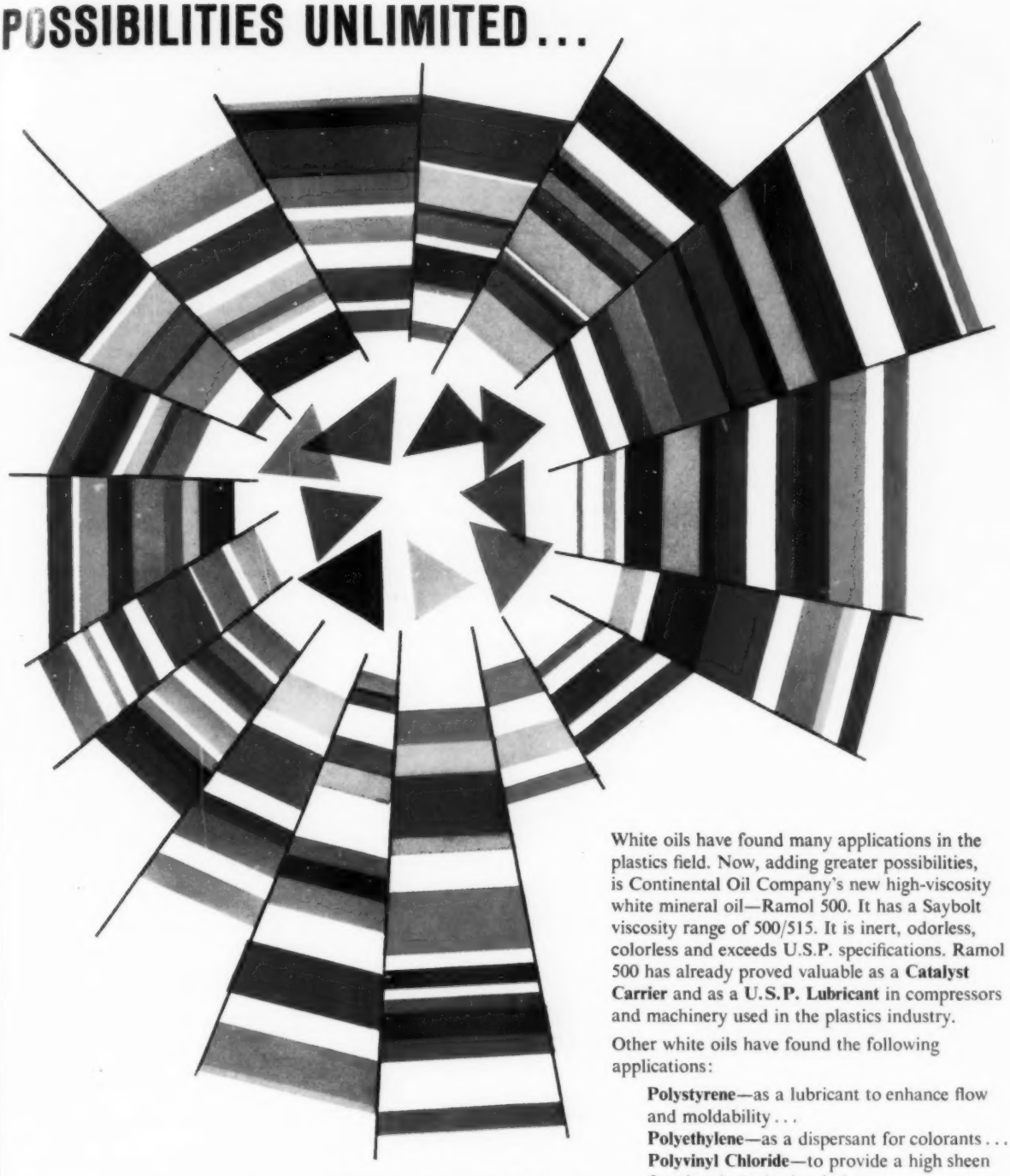

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Plasticizer production and sales, 1957

By Peter W. Spink and Walter F. Waychoff**

Plasticizer production in 1957 increased 5% over 1956. In a year of extreme competition, emphasis was placed on the most efficient use of established products. Development work on new plasticizers was concentrated on radically different chemical types. In 1957 the standard phthalate esters continued their growth as the principal plasticizers for polyvinyl chloride and, in general, strengthened the position of firmly established plasticizers in all resin classes.

Figures published by the U. S. Tariff Commission in its preliminary annual report listed plasticizer production in 1957 as 442,085,000 pounds. This represents a growth of 25 million lb. over the 416,788,000 lb. produced in 1956. This increase, while not as great as the 95 million lb. jump in 1955 over 1954, shows a stronger position than the 1955 to 1956 gain of 20 million pounds. The growth of plasticizers since 1950 is shown in Table I, below.

Of the amount produced in 1957, approximately 285 million lb. of plasticizer were used in compounding vinyl chloride and vinyl chloride copolymers. This represents about 64% of the total production. The remaining 157 million lb. include plasticizers used in other vinyls and in cellulosics, rubber, and miscellaneous resins. One must not forget that Tariff Commission figures include other uses for plasticizers, such as gasoline additives, lubricants, and functional fluids.

A typical breakdown of plasticizers by end-resin use from Tariff Commission figures is estimated in Table II, p. 184.

The published sales figure for 1957 on all plasticizers is 362,810,000 lb., or 80 million lb. below production figures. The difference is partly due to an inventory increase in 1957. But the largest percentage goes to captive use.

An estimated breakdown of the use of plasticizers in the largest PVC end uses is given in Table III, p. 184. The apparent discrepancy between Table II and Table III of 15,000,000 lb. can be explained by the epoxy materials which are used as combination stabilizers and plasticizers and which may appear elsewhere in the Tariff Commission report.

In 1957 there was little change in the acids used for manufacturing plasticizers. Most of these have been firmly established. A noticeable increase in the amount of isodecanol esters was noticed. Late in the year the increased supply of *n*-octyl, *n*-decyl alcohol created renewed interest in both phthalate and adipate esters of this alcohol.

Two classifications

The Government figures are divided into cyclic and acyclic classifications. The cyclic classifi-

*Plasticizers Sales Dept., Organic Chemicals Div., Monsanto Chemical Co., St. Louis, Mo.

Table I: Growth of plasticizers since 1950

Year	*Production* (*millions of lb.*)	*Growth over preceding year* (*millions of lb.*)	*Growth over preceding year* %
1950	242	—	—
1951	280	38	15.7
1952	266	−14	−5.0
1953	292	26	9.8
1954	300	8	2.7
1955	395	95	31.6
1956	416	21	5.3
1957	442	26	5.8

United States production and sales of plasticizers*

Chemical	Production 1954	Production 1955	Production 1956	Production 1957	1957 Sales Quantity	1957 Sales Value	1957 Sales Unit Value[a]
	1000 lb.	1000 lb.	1000 lb.	1000 lb.	1000 lb.	$1000	(per lb.)
GRAND TOTAL	**300,674**	**396,056**	**416,788**	**442,085**	**362,810**	**113,655**	**$0.31**
PLASTICIZERS, CYCLIC							
Total	**227,618**	**296,294**	**315,343**	**329,176**	**265,369**	**76,257**	**.29**
Phosphoric acid esters, **total**	—	—	—	**54,536**	**44,119**	**14,536**	**.33**
Tricresyl phosphate[b]	23,847	34,194	32,265	29,944	26,808	8,180	.31
Triphenyl phosphate	6,426	8,632	8,318	8,991	—	—	—
All other	—	—	—	15,601	17,311	6,358	.37
Phthalic anhydride esters, **total**	**170,610**	**212,815**	**237,382**	**251,157**	**200,714**	**56,370**	**.28**
Butyl decyl phthalate	—	1,036	3,869	4,582	4,382	1,150	.26
Dibutyl phthalate	19,876	23,858	22,017	17,631	12,121	3,204	.26
Dicapryl phthalate	5,832	—	3,667	—	8,346	2,238	.27
Dicyclohexyl phthalate	—	—	—	5,944	2,958	1,479	.50
Diethyl phthalate	15,999	15,799	18,661	18,281	11,506	3,032	.26
Diisodecyl phthalate	—	8,968	17,038	24,431	16,584	4,760	.29
Di (2-methoxyethyl) phthalate, [Di (methyl cellosolve) phthalate]	2,098	3,005	3,247	2,388	1,123	372	.33
Dimethyl phthalate	2,557	3,950	4,037	3,293	3,442	905	.26
Dioctyl phthalates, **total**	88,224	102,287	111,661	113,052	91,903	24,701	.27
Di (2-ethylhexyl) phthalate	54,067	71,640	80,632	73,568	57,161	15,201	.27
Diisooctyl, di-n-octyl, and mixed octyl phthalates	34,157	30,647	31,029	39,484	34,742	9,500	.27
Octyl decyl phthalate	10,060	13,102	11,269	13,319	10,323	3,101	.30
All other	25,964	40,810	41,916	48,236	38,026	11,428	.30
All other cyclic plasticizers[c]	26,735	40,653	37,378	23,483	20,536	5,349	.26
PLASTICIZERS, ACYCLIC							
Total	**73,056**	**99,762**	**101,445**	**112,909**	**97,441**	**37,398**	**.38**
Adipic acid esters, **total**	**7,037**	**10,592**	**8,504**	**8,975**	**7,092**	**3,002**	**.42**
Didecyl adipate	—	1,472	1,150	1,294	1,586	612	.39
Di (2-ethylhexyl) adipate	2,710	2,651	1,128	1,828	2,160	851	.39
Diisobutyl adipate	—	—	—	359	—	—	—
Diisooctyl adipate	884	1,592	2,218	1,826	1,111	401	.36
All other	3,443	4,877	4,008	3,668	2,235	1,138	.51
Azelaic acid esters	—	—	9,474	5,854	5,271	2,388	.45
Glyceryl monoricinoleate	—	287	301	334	304	105	.35
Lauric acid esters[d]	55	—	—	—	—	—	—
Oleic acid esters, **total**	**10,085**	**11,545**	**10,084**	**10,033**	**7,566**	**2,473**	**.32**
Butyl oleate	—	1,999	1,858	2,006	500	107	.21
Methyl oleate	—	811	693	817	—	—	—
All other	—	8,735	7,533	7,210	7,166	2,366	.33
Phosphoric acid esters	6,122	10,412	6,565	10.221	8,406	3,617	.43
Sebacic acid esters, **total**	**6,566**	**9,305**	**11,702**	**12,553**	**9,724**	**5,260**	**.54**
Dibutyl sebacate	1,950	3,435	3,111	3,595	1,063	699	.66
All other	4,616	5,870	8,591	8,958	8,661	4,561	.53
Stearic acid esters, **total**	**5,469**	**9,628**	**10,586**	**9,903**	**5,182**	**2,220**	**.24**
Butyl stearate	3,647	6,368	7,085	5,892	5,711	1,226	.21
All other	2,822	3,260	3,501	4,011	3,471	994	.29
Triethylene glycol di (caprylate-caprate)	—	2,031	1,440	2,315	2,151	736	.34
All other acyclic plasticizers[e]	36,722	45,962	42,789	52,721	47,645	17,597	.37

*All figures are from U. S. Tariff Commission reports.
[a] Calculated on rounded figures.
[b] Includes material produced for use as motor fuel additive.
[c] Includes data for synthetic camphor, toluenesulfonamides, tetrahydrofurfuryl oleate, and other cyclic plasticizers.
[d] Tariff Commission through 1954 listed these separately; in 1955 they were included in "All other acyclic plasticizers."
[e] Includes data for citric and acetylcitric, palmitic, tartaric and ricinoleic acid esters, and for butyl myristate; glyceryl and glycol esters of certain fatty acids, glyceryl tripropionate, complex polymeric materials and other acyclic plasticizers.

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Table II: Estimated end-resin use of plasticizers

Resin	*lb.*
Polyvinyl chloride and copolymers	285,000,000
Other vinyls	40,000,000
Cellulosic resins	50,000,000
Rubber	20,000,000
Other resins and non-plasticizer/resin combination uses	47,000,000

cation contains aromatic and benzene nuclei. A major deviation in the figures for cyclic plasticizers was necessitated in the report this year by the removal of "All other phosphoric acid esters" from the "All other cyclic plasticizers" column and placed into their proper place under phosphoric acid esters.

Acyclic products do not contain aromatic groupings. They consist primarily of aliphatic chemicals which are derived from fats, vegetable oils, fermentation products, and natural gas. A major portion of acyclic plasticizers is contained under the general heading of "All other acyclic plasticizers." The products specifically contained in this heading have always been difficult to define and only an educated guesstimate can be made as to how many of the currently popular polymeric and epoxidized stabilizing plasticizers are included in this group.

Cyclic plasticizers

Phthalate esters, as might be expected, continued their dominance of the plasticizer field, representing 251 million lb. of the 442 million lb. produced, or roughly 57 percent. This figure has not changed significantly in the past several years, although it annually shows a slight increase. The largest percentage of this type of plasticizer, or 183 million lb., went into compounding of vinyl chloride and vinyl copolymer resins. Among the phthalate plasticizers, the most important remained the octyl phthalate type, including di(2-ethylhexyl) phthalate, diisooctyl phthalate, and combinations of these two with isodecyl phthalate. Other

Table III: Plasticizer use in PVC

Use	*Resin*[a]		*Plasticizer*
	lb.		*lb.*
Film	82,000,000		33,000,000
Sheeting	83,000,000		37,000,000
Fabric treatment	55,000,000		33,000,000
Paper treatment	10,000,000		3,000,000
Floor covering	82,000,000		29,000,000
Molding and extrusion	240,000,000		128,000,000
Phonograph records	35,000,000	1,000,000	
Slush and elastomeric molding	48,000,000	41,000,000	
Garden hose	7,000,000	3,000,000	
Profile extrusion	44,000,000	26,000,000	
Wire	89,000,000	53,000,000	
Rigid	10,000,000		
Miscellaneous	7,000,000	3,000,000	
Protective treatment	34,000,000		7,000,000
Miscellaneous	61,000,000		30,000,000
TOTAL	647,000,000		300,000,000

[a]From M. PL. January 1958, p. 98.

eaders in this field are diisodecyl phthalate, dicapryl phthalate, butyl benzyl phthalate, octyl decyl phthalate, butyl octyl phthalate, and butyl decyl phthalate.

While the total for octyl phthalate types increased slightly in 1957, production figures for di(2-ethylhexyl) phthalate (DOP) showed a slight drop. DOP is still considered the basic building type plasticizer—principally because of its excellent compatibility with vinyl, balance of properties, and current price.

Diisooctyl phthalate continued to grow in 1957—probably at a greater rate than indicated.

Diisodecyl phthalate in 1957 showed a very interesting growth increase. It went from 17 million lb. in 1956 to 24.5 million lb. in 1957—or better than a 40% increase in one year. It seems certain that the major fields accounting for this increase are electrical wiring compounds and extrusions. The low volatility, excellent electrical properties, and superior physical retention properties of DIDP (especially in the stabilized grades) make it increasingly popular in appliance wire applications. Because of extreme resistance to soapy water extraction, it has been used in film for baby pants and shower curtains, and has wide plastisol applications.

Octyl decyl phthalate showed an upturn in 1957, primarily because of its incorporation in U/L graded wiring compounds, replacing DOP to improve retention of elongation on heat aging.

Late in the year, *n*-octyl, *n*-decyl alcohol was again available in increased volume. This has renewed the interest in di(*n*-octyl, *n*-decyl) phthalate—especially at the reduced sales price. This material should definitely grow in 1958.

In 1957, butyl octyl phthalate and butyl decyl phthalate increased in volume. These products, offered at a more attractive price than DOP, and with equal flexibility but increased volatility, are primarily used in flooring, extrusion, sheeting, plastisol, and cellulosic applications. Proprietary and specialty plasticizers, such as dicapryl phthalate, butyl benzyl phthalate, and butyl cyclohexyl phthalate, continue to

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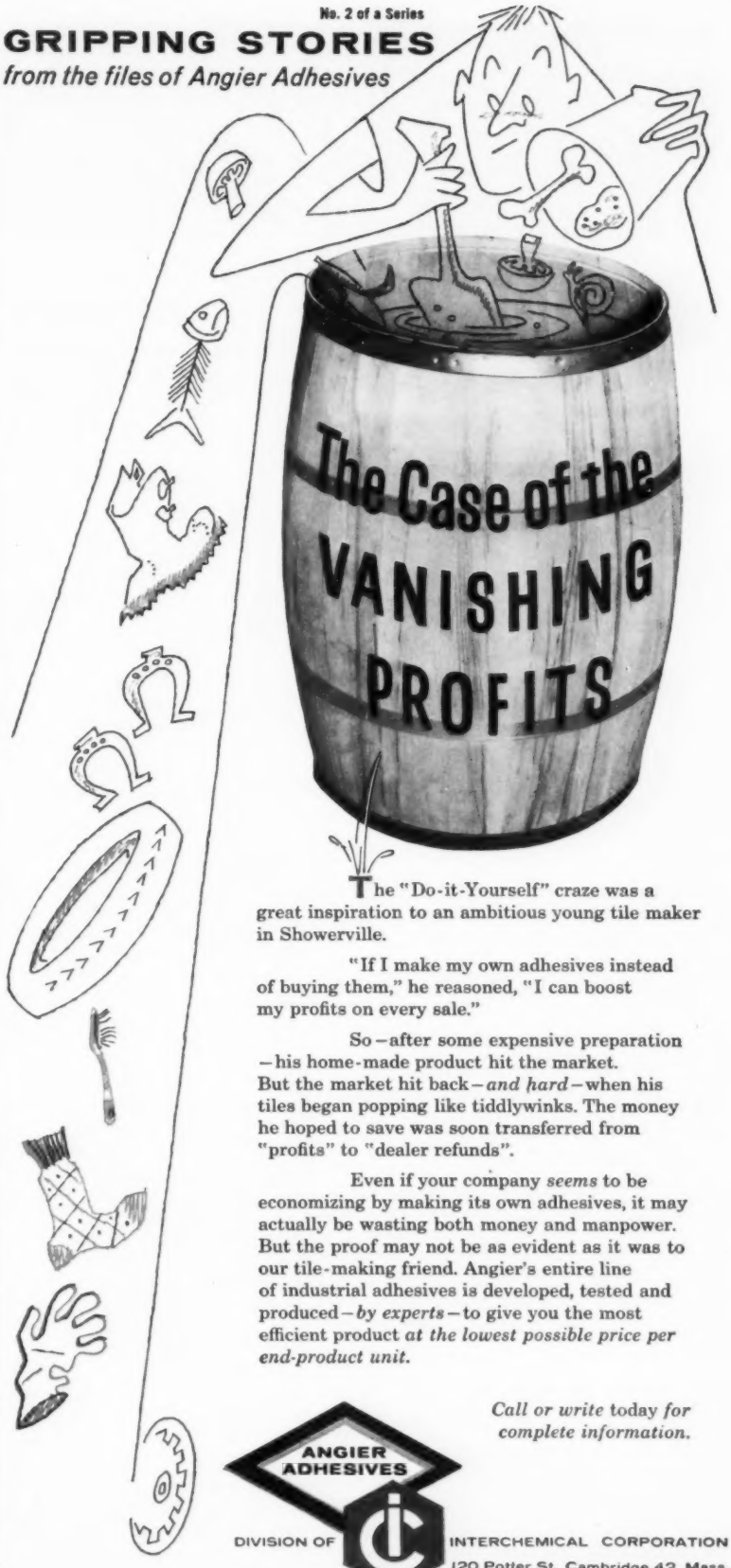

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grow. Dicapryl phthalate, seemingly, is more plentiful on the market and is enjoying popularity in the dispersion field where its low initial viscosity is often required. Butyl benzyl phthalate is used in the flooring field because of its resin and filler wetting characteristics and resistance to extraction by oils and greases.

Many blends were introduced in 1957, principally to provide custom-tailored products for specific applications. Because of the complexity and secrecy of these blends it is practically impossible to determine the total amount sold and into what end applications they might be going.

In the field of non-vinyl phthalate plasticizers, dibutyl phthalate showed a decided drop. This is primarily due to the decreased use of this product in ordnance applications since it remains a standard in nitrocellulose lacquers, vinyl acetate adhesives, and protective coatings.

Diethyl phthalate in 1957 surpassed dibutyl phthalate for the first time. To date its major use is as a plasticizer for cellulose acetate, often combined with dimethyl phthalate. It has smaller uses in polyvinyl acetate and is still used in some ordnance applications, although more recent technological findings have tended to diminish its importance.

Dimethyl phthalate and di (2-methoxy ethyl) phthalate showed slight drops in 1957. From these and other figures it may be inferred that established plasticizers for non-vinyl uses have not shown an increased growth curve in the past few years, but have remained stationary. In addition to cellulose acetate coplasticizers, dimethyl phthalate finds use as an insect repellent.

Phosphoric acid esters: In 1957, tricresyl phosphate dropped somewhat from the 1956 production total. Since this product has shown little variation over the past few years in its use as a true plasticizer, this is reflected primarily in its use in the petroleum industry. Of the 30 million lb. sold in 1957, it is estimated that 10 million lb. were used with synthetic resins and approximately 20 million lb. in other uses.

TCP remains the most perma-

nent monomeric plasticizer and is well established as a flameproof plasticizer for polyvinyl chloride as well as cellulosics. Its use in wire insulation is diminished by the use of polymeric plasticizers and diisodecyl phthalate.

Triphenyl phosphate is widely used in the cellulose acetate field as a flame-retarding plasticizer in combination with low molecular weight phthalate type esters.

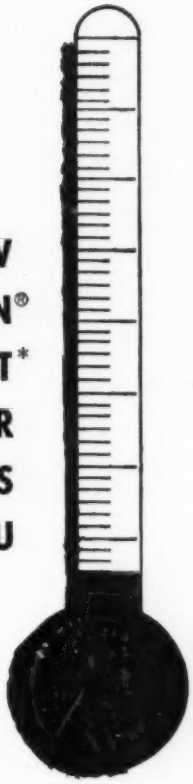
For the first year, other phosphate plasticizers, such as alkyl aryl, cresyl diphenyl, etc., are reported under the phosphoric acid heading in the Tariff Commission's figures. This brings about a corresponding increase under this heading, but a drop under the "All other cyclic plasticizer" column where they used to be reported. These products as a group are finding increased use in vinyl film, sheeting, and foam, and in some cellulosic applications. Cresyl diphenyl phosphate types are often preferred to TCP because of better flexibility and slightly superior light stability and resistance to outdoor exposure. Aryl alkyl phosphates often combine non-toxicity with fire retardancy and DOP-like general characteristics.

Sulfonamide plasticizers. Toluene sulfonamides continue as a specialized, highly polar group of plasticizers, particularly useful in cellulose acetate, polyvinyl acetate, polyamides, melamines, and phenolic resins.

Miscellaneous plasticizers. Chlorinated biphenyls offer a wide variety of properties. Their major use during the year 1957 was in polyvinyl acetate adhesives, cellulosic hot melts and lacquers, and styrene-butadiene compounds, and, to a lesser extent, as secondary plasticizers for vinyl chloride. Other miscellaneous plasticizers listed are synthetic camphor, tetrahydrofurfuryl oleate, phthalyl glycollates, and extender plasticizers derived from petroleum products.

Acyclic plasticizers

Adipic acid esters. Adipate esters are used as specialty products to impart excellent low temperature flexibility to vinyl, rubber, and miscellaneous resin compounds. Both diisodecyl adi-



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Comparison of Plastolein 9078 with di-decyl adipate

	Plastolein 9078	DDA	Plastolein 9078		DDA
Parts Geon 101	100	100			Borderline
Parts Plasticizer	48	49	Masland Impact, ° C	—40	at —40
Tensile, psi	2650	2400	Extraction, mg/in²		
Elongation, %	365	360	Water, 24 hrs. @ 50° C	0.2	0.1
Modulus, 100%, psi	1130	1240	Soapy Water, 24 hrs.		
Hardness, D.10 sec.	85	89	@ 50° C	1.0	0.4
Volatility, SPI, 70° C			Min. Oil, 24 hrs. @		
1 day-mg/in²	1.9	2.3	25° C	11.1	19.8
7 days-mg/in²	8.0	9.1	Compatability, Roll		
			Spew	Slight	Severe

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pate and di (*n*-octyl, *n*-decyl) adipate have lower volatility than dioctyl adipate and are generally preferred for this reason. Diisobutyl adipate finds use as a non-toxic plasticizer, while dibutyl cellosolve adipate is used primarily as a plasticizer for vinyl butyral in safety glass.

Azelaic acid esters. A sizeable drop in the production of azelaic acid esters in 1957 is hard to explain. The most noticeable of these, dioctyl azelate, is used as a flexibilizing plasticizer in coated fabrics and as a lubricant.

Phosphoric acid esters. Production of acyclic phosphoric acid esters increased sizeably in 1957 over 1956. The chart on p. 183 shows that this production figure is close to that of 1955. At this point the curious repeated cycle in the production of these materials is not explainable. The major plasticizer here is trioctyl phosphate, which finds application as a low temperature, fungus resistant plasticizer in vinyl coatings. Tributyl phosphate is used in a non-plasticizer application. Tributoxy ethyl phosphate has gained interest with the advent of polystyrene floor wax systems and tri-beta-chloroethyl phosphate is used as a flame-retardant plasticizer in cellulosics and in some polyurethane foams.

Sebacic acid esters. The production of sebacic acid esters increased in 1957, although the use of these materials with synthetic resins probably remained constant at about 3 million lb. annually. This growth reflects primarily increased use of the product as a functional fluid and lubricant.

Stearic acid esters. The production of stearic acid esters dropped slightly in 1957. The major use for these materials as plasticizers is for cellulosics with some sales to vinyl acetate and polystyrene applications. The sales of stabilizing plasticizers, such as epoxidized stearates, are only partially listed under this classification.

Polymeric plasticizers. Polymeric plasticizers (polyesters of dibasic acids and glycols) are, by independent sources, estimated at 25 million pounds. Since these materials are chemically similar to alkyds, it would appear from detailed analysis of the Tariff Commission figures that not all polymeric plasticizers are listed in the "All other acyclic plasticizers" category, but are probably shown in other segments of the report.

Other acyclic plasticizers. This category has always been very difficult to define since it includes many plasticizers. These consist principally of esters of citric, palmitic, tartaric, ricinoleic, and similar acids, which find use in a variety of plasticizer and lubricating applications.

The trend

It is always difficult to predict the forward trend of plasticizers. However, standard plasticizers will undoubtedly continue to be competitive in established products. At this time it seems certain that new developments, particularly in the field of high temperature requirements, will expand the plasticizer market.—END

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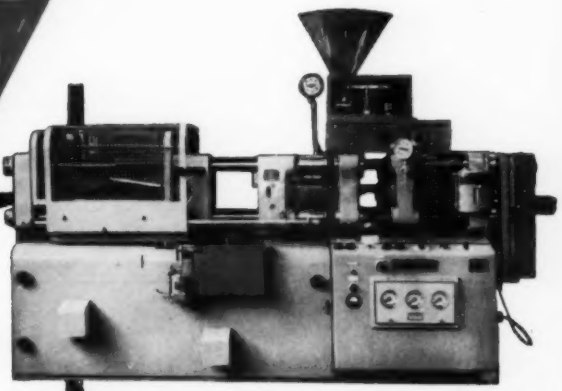

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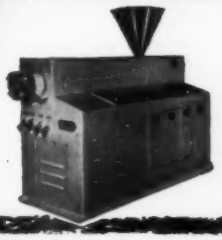

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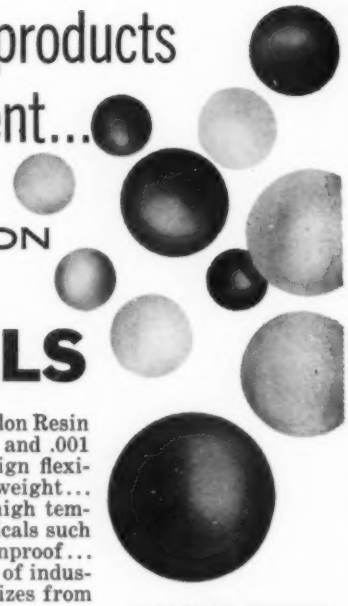

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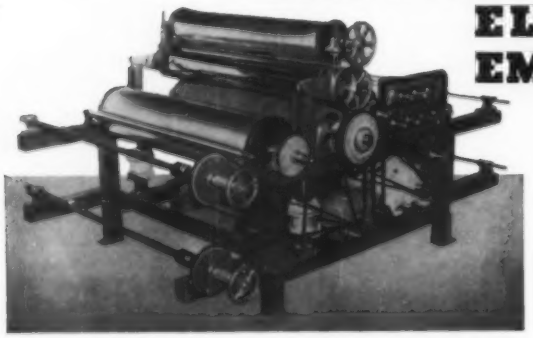

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A quick and easy method of pinning and trimming torso-type window and counter displays is now made available to the ladies' ready-to-wear and allied trades with the introduction of the Easy-Pin expanded polystyrene blouse and sweater shell.

Molded of Koppers' Dylite expandable polystyrene by Economy Cover Corp., 369 DeKalb Ave., Brooklyn, N. Y., the display shell has many advantages over conventional papier mâché and rigid molded polystyrene forms. It weighs 9 oz.—compared with 16 oz. each for its competitors—is washable, unbreakable, gives a lifelike, natural look to the item displayed, and reportedly cuts trimming time in half.

Pricewise, the Easy-Pin costs $4.25. Its competitors sell for $2.75 and $4.75 respectively. But, as indicated above, price is not the only factor.

The shell comes in either flesh color or white with a gold mottled effect. It is supplied with a swivel attachment, plus an adapter for both ¼- and ⅜-in. tee stands.—END

Molded polystyrene display shell (above) provides quick and easy pinning. Rear view (right) shows simplicity and full-round shape of shoulders

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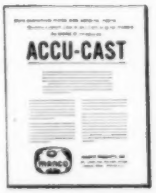

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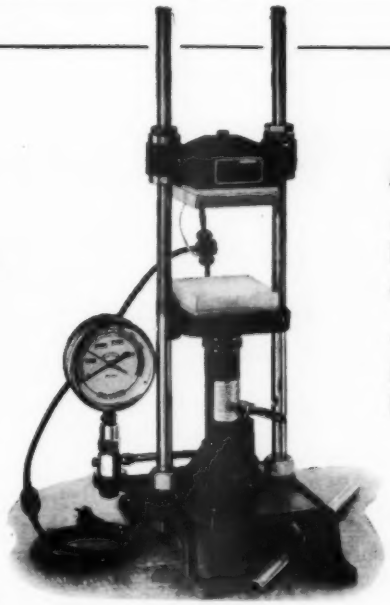

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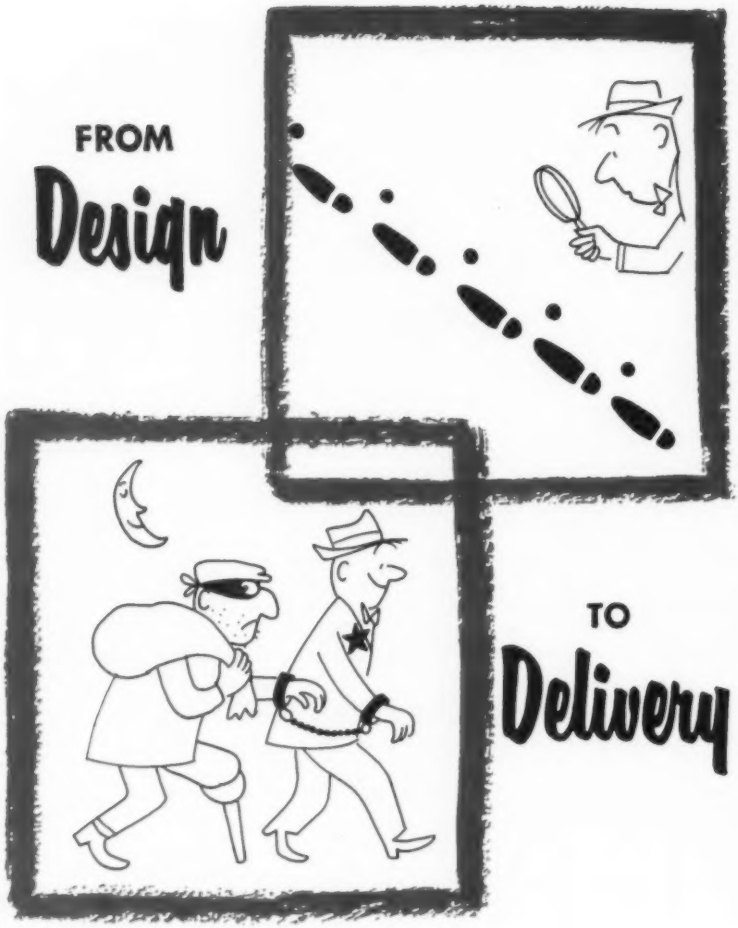

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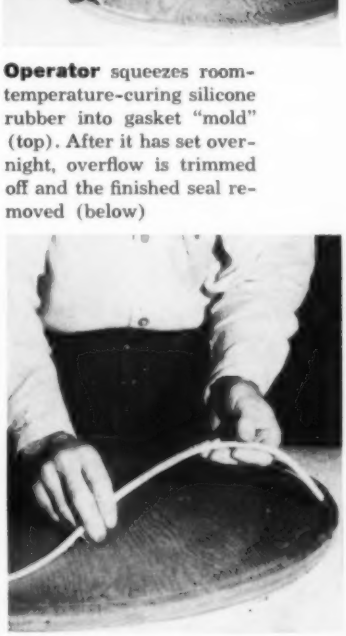
Inexpensive seals for prototype molds

Seals for its epoxy molds used in the production of reinforced polyester prototype parts are now being made by Tru-Scale, Inc., Wichita, Kans., at a fraction of the cost of gaskets custom molded of ordinary rubber.

The company uses Silastic RTV silicone rubber, produced by Dow Corning Corp., Midland, Mich., to make its own seals. The material vulcanizes without heat or pressure.

To make the seals, a groove of proper diameter and design is routed out of plywood, polished, and rubbed down with wax for easy release and smooth finish. The silicone is then squeezed into the groove and allowed to set overnight. After the overflow is trimmed off, the seal is removed, ready for use. Material cost for 24-in.-diameter ring is $1.25.

Operator squeezes room-temperature-curing silicone rubber into gasket "mold" (top). After it has set overnight, overflow is trimmed off and the finished seal removed (below)



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Superior wetting properties of Isophthalic resins reduced fabricating time and costs; the sections were quickly fabricated by using a contact layup over a male mandrel.

Isophthalic polyester resins with the epoxy strengths are continually solving tough application problems, providing the reinforced plastics manufacturer with new, years-ahead products. Contact your resin supplier or Oronite directly—see how Isophthalic resins can benefit the products you manufacture or market.

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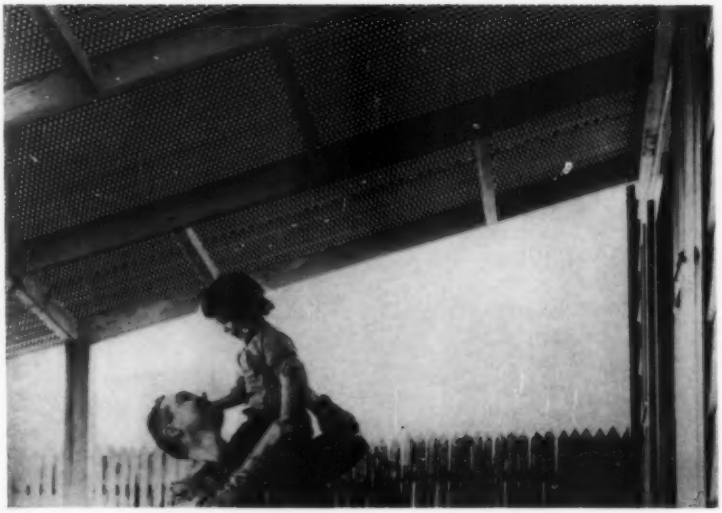


Reinforced plastics panels, with interlayer of aluminum foil, are designed to reflect approximately 80% of the sun's heat and to keep the area below cool

Reinforced plastics-foil roofing panel

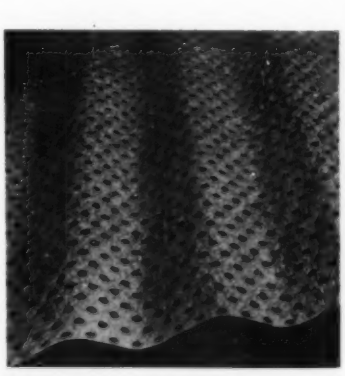
A new type of decorative reinforced plastics panel, designed to reflect more than 80% of the sun's heat, employs an interlayer of aluminum foil as a heat barrier. Small holes in the aluminum foil permit soft, diffused light to pass through.

The foil-plastics panel was developed by Resolite Corp., Zelienople, Pa., as a solution to the problem of heat built-up under translucent reinforced plastics roofs in bright sunlight.

When used in roof construction, the new panels, called Foil-Glass, provide enough light transmission to assure a shadowless, bright covered area, the manufacturer claims. The panels are produced in four colors—coral, blue, green, and yellow. Sheets are available in 26- and 40-in. widths and lengths of 8, 10, and 12 feet. Foil-Glass retails for about $1.25 a sq. foot.

In producing the new panel, a thin sheet of perforated, embossed aluminum foil is laminated between two layers of fibrous glass mat impregnated with polyester resin. After heat curing, the finished panel is surface treated to provide an ultra-violet screen that increases color and weather stability.

Foil-Glass is reported to have higher impact strength than conventional reinforced plastics panels because the foil layer strengthens the sheet in much the same way that the inner plastics layer strengthens safety glass. The product can withstand extreme wind and snow loads, according to Resolite. The panels are also said to have high flame resistance because the aluminum foil dissipates the heat so rapidly that localization of high temperatures and consequent combustion cannot take place. The panels can be sawed and nailed or screwed in place—using ordinary hand tools —in the same way as standard reinforced plastics panels.—END



Close-up of panel shows details of perforations which permit light to pass through. (Photos, Resolite Corp.)

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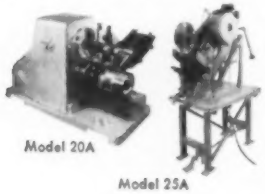

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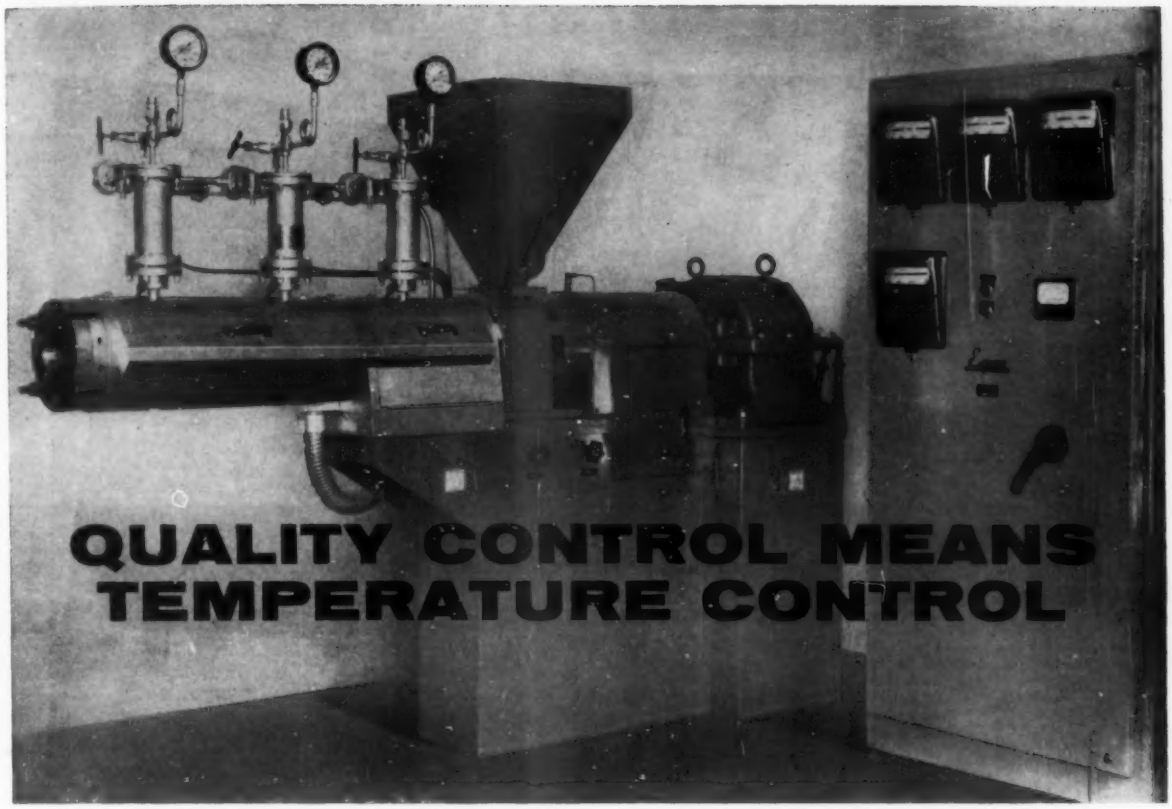
Vinyl sign for increased sales

An arrow-shaped vinyl-sheet merchandiser is the latest in a line of plastic pricing, merchandising, and display products offered by Shaw & Slavsky, Inc., Detroit, Mich.

The sign, called an Impulse-Spotter, is die-cut and formed by punch-press operations out of 0.020-in. sheet material. Over-all size is approximately 5 by 4 inches. Equipped with a flexible wire mount which fits all price tag moldings from ⅞ to 2 in., the spotter can be used on practically any display in a market. It has good visibility at a distance yet is said not to interfere with aisle traffic.

Slots in the merchandiser permit insertion of changeable copy messages. These messages can be price information or, printed on an arrow indicator, such slogans as "Special Today," "As Advertised," etc. The arrow inserts are also fabricated of vinyl sheet. Several producers of brand-named grocery items, among them Redi-Whip, White Rock, and others, are using them for the purpose of increased product identification.

Retail price for the spotter is about 58¢ each, with wire mount. Inserts are individually priced. Substantial discounts have been set up for jobbers and chains. Sheet material for the signs is supplied by Nixon Nitration Works, Inc., Nixon, N. J.—END



Egan Extruder With "Willert Temperature Control System" Automatically Eliminates Temperature Variations

Heating the plastic material in the extruder cylinder, whether by conduction, induction, or friction, is no problem — assuming the designer has provided sufficient heating capacity and a properly designed screw.

However, provision for efficient dissipation of excessive heat is essential to make any temperature control system complete.

The Willert System is the ultimate in complete control! Excessive heat is removed automatically without moving parts, and without any manual operation of valves or switches by the operator. As a result, closer tolerance extrusions are produced easier and faster.

The Egan Extruder shown above, complete with "Willert Temperature Control System," is available in sizes from 2" through 10". It incorporates standard Egan features such as: herringbone gears, separate heavy duty thrust bearing assembly, complete control panel, wiring, piping, hinged covers for easy access to thermocouples, hopper, screw speed tachometer, and ammeter. Additional features are available.

Write, or Phone Randolph 2-0200,
For Complete Information — No Obligation.

Egan **FRANK W. EGAN & COMPANY**

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Manufacturers of plastics extruders, dies, take-offs, and other accessories

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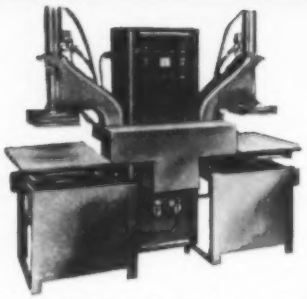
PRESS THE BUTTONS



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Whatever the power rating you require, every Sealomatic Electronic Heat Sealer provides the full power you must have for perfect results every time. The fact is that every Sealomatic is built with electronic components that will last longer in the brutal grind of daily production. In addition, Sealomatic's ease of operation because of its many "extra" features, assures immediate full production even with unskilled help.

Why let "skimpy power" rob you of the quality production you require? For more facts on electronic heat sealing, write or phone today for Sealomatic's helpful brochure, and arrange to see a representative. Remember, there are standard model Sealomatics from ½KW to 30 KW, including automatic turntable units, as well as models for applique work, lamp shade work, and automatic roll feeding. Thermal units are available for blister packaging and fast drying of adhesives.

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ELECTRONICS CORPORATION
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Fertilizer packed in 50-lb. bags made of extruded polyethylene can be unloaded when and where needed—even in middle of puddle. When empty, bags have important re-use value as tarpaulin material

Fertilizer bags double as tarpaulins

A new market for polyethylene film, with a conservatively estimated potential of 7 million lb. of resin per year, has been established with the introduction of 10-mil, 50-lb.-capacity bags for packaging ammonium nitrate fertilizers. The application is pioneered by Spencer Chemical Co., Kansas City, Mo., producer of both the polyethylene resin and the fertilizer.

Primary advantages of the new bags over the polyethylene-coated multi-wall paper bags currently being used are:

1) Reuse. After bags have been emptied, they can be used for heavy-duty miscellaneous storage; or they can be cut apart at the seams and heat-sealed by the farmer into tarpaulins following available instructions.

2) Protection. Because the bag is completely moistureproof, it eliminates any problem of the fertilizer caking during storage.

Price is 22 to 25¢ per bag, depending upon the application; but it is expected to drop as production economies are effected.

The new bags, extruded and fabricated by Chippewa Plastics, Inc., Chippewa Falls, Wis., of 0.917-density resin, are filled on automatic paper bag filling machines, adapted to handle polyethylene, which is more flexible and has more slip than paper.

So far this year, Spencer has bagged more than 7000 tons of fertilizer in the new bags.—END

Tractor cover, waterproof and tear resistant, has been fabricated by farmer from empty 10-mil polyethylene fertilizer bags

Custom
Perforating

—on all types of flexible materials, rigid sheets, and foam.

plastics
cellophane
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fabrics
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in sheets and rolls up to 72" wide

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So consider a ball for your purpose—and consider the job well done by ORANGE PRODUCTS.

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Reduce Operating Costs — Increase Production Eliminate Returns and Delays

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Gives uniform blend every time to end products. Accurate feeders assure exact matching of batches.

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Your pay load up to 2000 lbs. per hour because costly, time consuming operations like weighing out, timing, tumbling and handling are eliminated.

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No need to tie up money and precious floor space in prepared raw materials in numerous colors. All you need is color concentrate and clear or neutral plastics.

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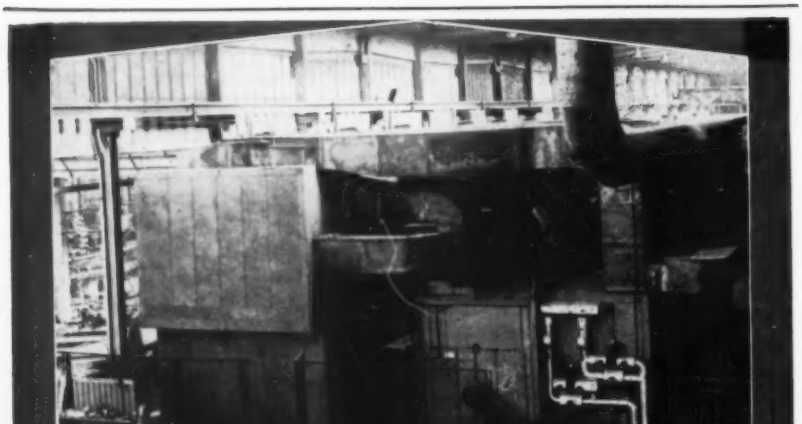

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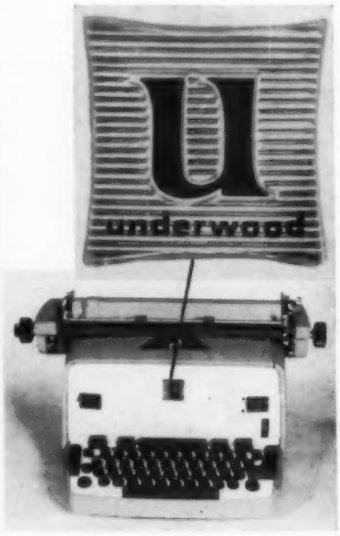
Trademark in acrylic

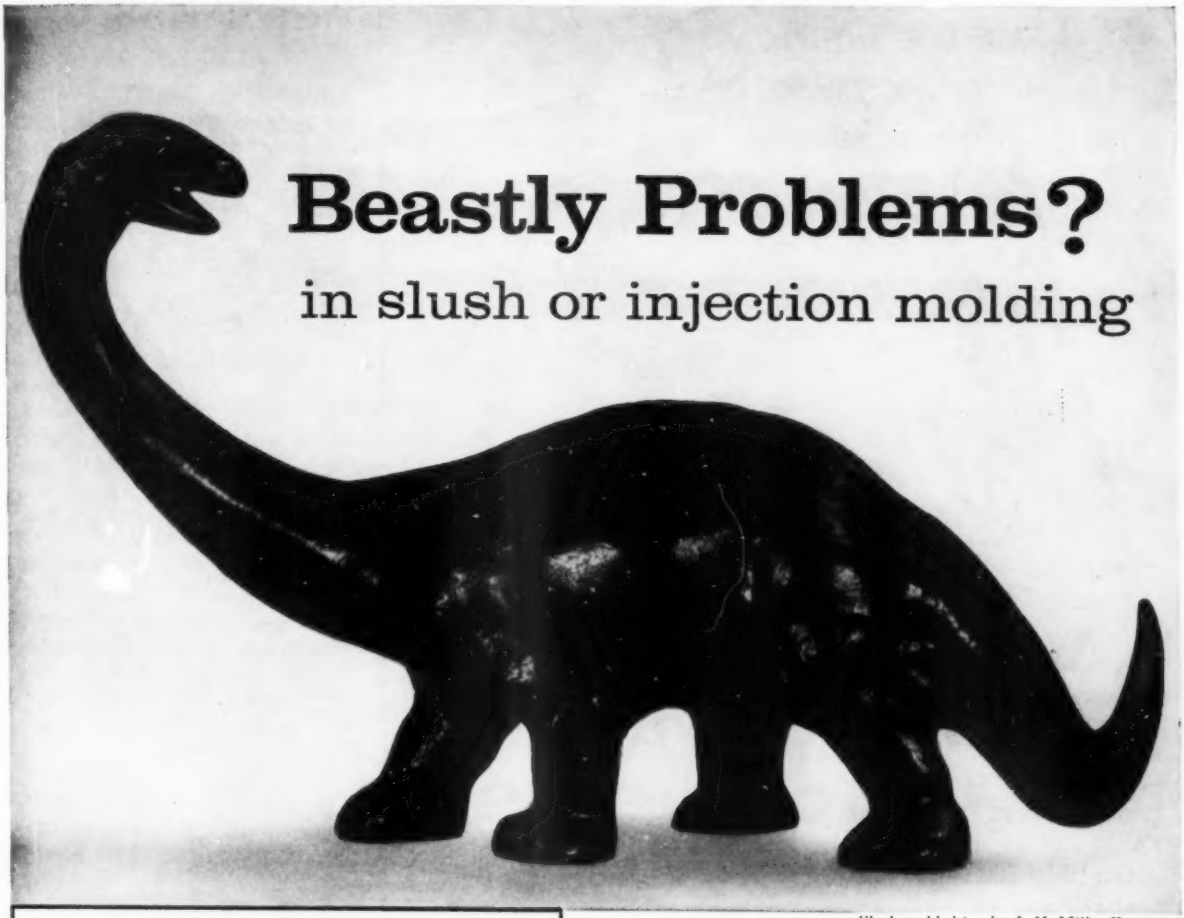
The trend toward replacement of metal and stenciled nameplates on typewriters with plastics emblems has been further accentuated with the introduction of a molded acrylic representation of Underwood Corp.'s redesigned trademark on the company's new line of electric typewriters. Produced in striking colors, the escutcheon shows a dull-black "u" on a field of gold, and is intended to symbolize the new Underwood corporate image: modern and progressive.

The device, measuring approximately 1¼ by 1¼ in.—as well as the typewriter itself—was designed by industrial designer Raymond Spilman, New York, N. Y. Acrylic was chosen because the decorative potential inherent in the material made it particularly suitable for this application.

Kent Plastics Co., 1528 N. Fulton Ave., Evansville 10, Ind., injection molds the medallion in a four-cavity mold. Weight per shot is about ¼ ounce. Two studs molded into the back permit easy attachment to the typewriter by means of spring clips.

The three-dimensional, two-color effect is achieved by second-surface coating technique, i.e., first the "u" is spray-painted black and a tinted lacquer put on all areas not black. Finally a vacuum-metallized aluminum coating is added, protected by clear lacquer.—End





Beastly Problems?

in slush or injection molding

Slush molded toy by J. H. Miller Company

A-C® Polyethylene makes them extinct!

INJECTION MOLDING

Leading plastic molders are using A-C Polyethylene to produce superior polyethylene articles. Controlled gloss, better color dispersion, and the ability to run larger, more intricate parts are features of using A-C Polyethylene. Faster cycles, positive mold release, lower operating temperatures and less overall machine maintenance, are the profit-making advantages that contribute to the molders profits. By a simple change of percentages of A-C Polyethylene blended with virgin Polyethylene you can tailor-make a wide range of characteristics which would normally require a large investment in inventory, covering many grades. The proper flow to meet any molding problem is under your complete control.

SLUSH MOLDING

Polyethylene for slush molding is brand new! Now, using a blend containing low-viscosity A-C Poylethylene, parts can be fabricated from small pieces like the toy dinosaur above to 50 ounce parts. Here's an entirely new low pressure process offering faster cycles with low mold and machine costs. Because molds are inexpensive, short runs are economical for polyethylene parts using this entirely new material. Adaptable to individual piece, semi-automatic and automatic operations, slush molding with polyethylene provides new control of molding costs with detailed, high quality finished parts. Only A-C Polyethylene blends give maximum results for a wide range of working conditions.

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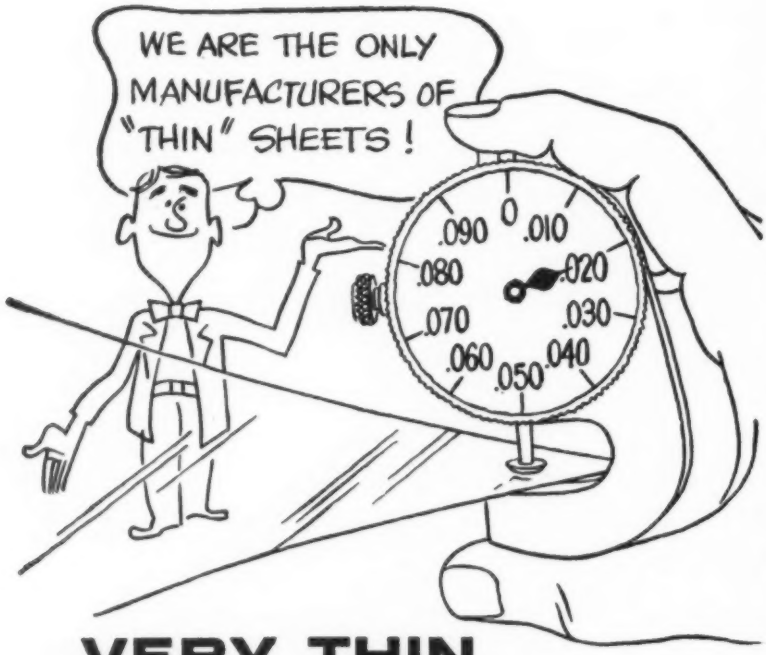

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Manufacturers of EVR-KLEER* Rigid Plastic Sheets

EVR-KLEER* Registered Trademark of Cast Optics Corp.

Plastisol-coated

(*From pp.* 96-98)

flexible steel tapes is now fabricating cases for the tapes from embossed Texkote steel stock. Use of the prefinished material provides important savings over the company's previous cases, which consisted of a basic stamped metal shell to which cloth or leather covers were cemented, involving a number of costly finishing operations.

Portable television cabinets are another important outlet for the plastisol-coated metal stock. Studies by one large manufacturer showed that producing a portable TV cabinet from this material resulted in a saving of approximately 40% as compared to a similar cabinet fabricated of uncoated stock and given a conventional paint finish. Comparative figures were $1.63 for the coated metal cabinet as against $2.68 for that requiring additional finishing operations.

Admiral Corp., Chicago, Ill., is now using the vinyl coated steel and aluminum to fabricate cases for several of its newest 17-in. portable TV sets. For these cabinets, Sun Steel cuts the material in 15- by 45-in. blanks. Supplied in several colors and finishes, the embossed plastisol coating offers an additional advantage of excellent electrical insulating properties which increase the safety factor in the event of possible shorting out of the chassis. Another advantage of the plastic coating for these cabinets is its thermal insulating properties. Despite the heat generated by the receiver, the exterior remains relatively cool to the touch.

Among other applications for which the Texkote material is now being evaluated are decorative interior wall panels to be rapidly fastened to wall surfaces on 16-in. centers, using a patented type of clip. Combining integral color and an embossed surface, they would be maintenance-free and long-lasting.

Credits: Primers and plastisols used in production of Texkote metal stocks supplied by Bradley & Vrooman Co., Chicago, Ill., using B. F. Goodrich Chemical Co. Geon vinyl resins.

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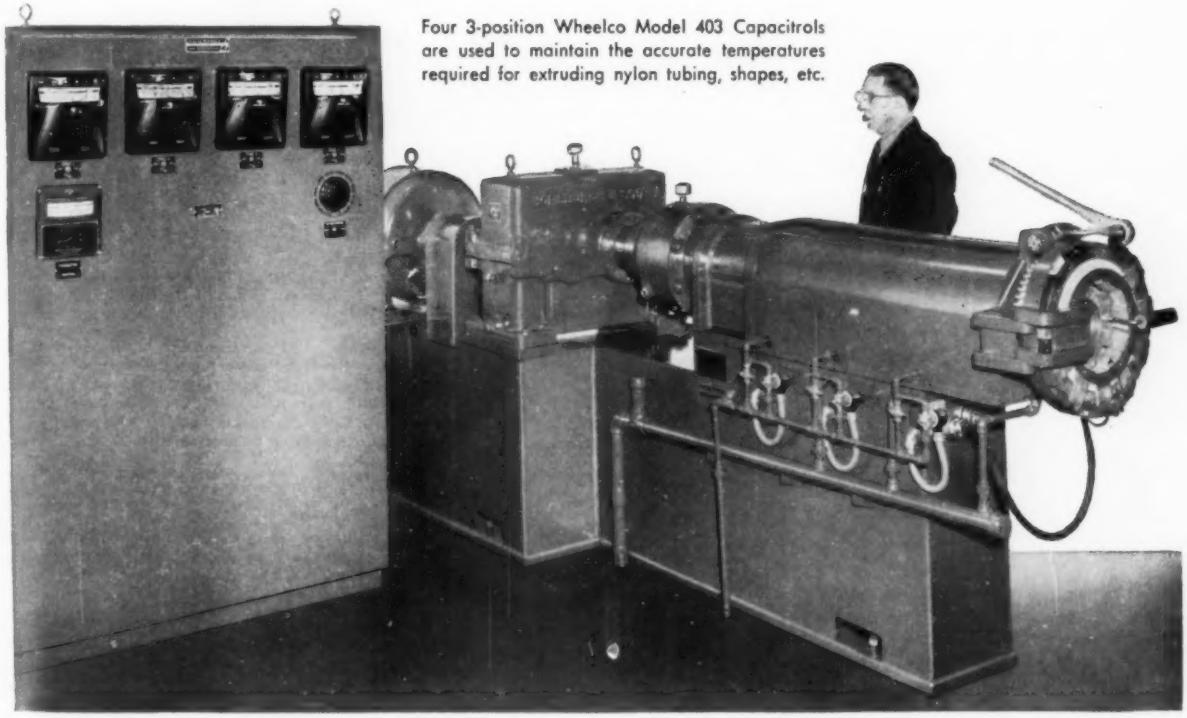
Automatic, multi-zone temperature control insures high-quality nylon extrusions

This induction-heated Aetna-Standard extruder with a Kullgren Temperature Control System always provides exactly the right temperature for extruding nylon tubing, shapes, etc. Three zones of automatic heating, plus provisions for cooling in the alloy steel barrel of the cylinder extension and a separate heat zone in the high-pressure head, insure precision control. Warmup from room temperature to 400° F takes less than 30 minutes, to 600° F takes less than an hour.

Wheelco Model 403 multi-position type controllers are ideal for this application because they were specifically designed for processes where one instrument is required to control both heating and cooling cycles.

Wheelco 400 Series Capacitrols offer you a choice of six control forms, so why take a chance on sacrificing product quality or operating efficiency by using an indicating controller that doesn't quite do the job? Bulletin F-6314-3 gives you the facts. Write for it today or get it from your nearby Wheelco field engineer. Learn for yourself why Wheelco continues to lead in plastics industry control applications.



Four 3-position Wheelco Model 403 Capacitrols are used to maintain the accurate temperatures required for extruding nylon tubing, shapes, etc.

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VYN-EZE, an anti-blocking agent imparts many desirable properties to vinyl film, sheeting and tubing, such as very good anti-tacking property and excellent clarity. VYN-EZE is approved by the Food and Drug Administration for use in materials in contact with food products.

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A high quality anti-static agent which does not discolor or soil, STAT-EZE is the answer to the annoying problem caused by static accumulation on carpeting, particularly nylon and synthetic blends, as well as wool, particularly in dry weather.

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(*From p. 99*)

bonded with phenolic and resorcinol adhesives.

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Igloos fabricated from polystyrene foam, duplicating almost exactly the ice and snow igloo of Eskimos, but drier, more healthy, and easier to heat.

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Decorative melamine wall panels; sandwich wall panels with plastic foam cores.

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Vinyl-clad metal wall surfaces.

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Light diffusers and luminous ceilings of vinyl, polystyrene, reinforced plastics.

Wall tile of polystyrene and vinyl. Epoxy and furane grout for ceramic tile.

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Sprayed-on vinyl and urethane foam coatings for longer service life, easier cleanability, corrosion resistance, and improved insulation.

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Rigid PVC fume hoods and ducting.

Vinyl-clad steel stacks.

Pipe of polyethylene, polyvinyl chloride, cellulose acetate butyrate, and reinforced plastics.

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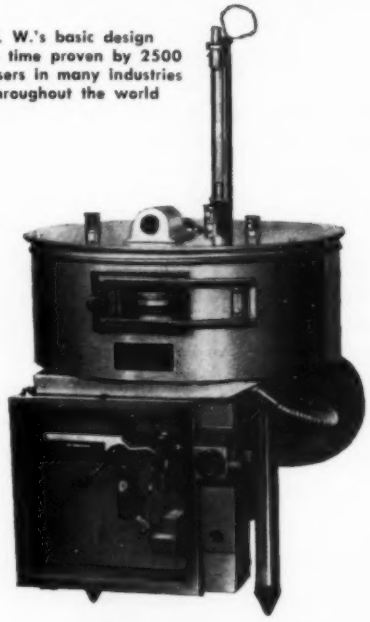
VOLATILES TESTER
(FOR PLASTICIZERS)

C. W.'s basic design is time proven by 2500 users in many industries throughout the world



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The German manufactured counterpart of this instrument is standard in the European Plastics Industry.

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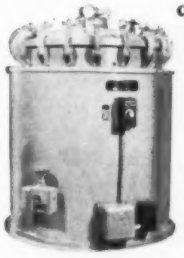

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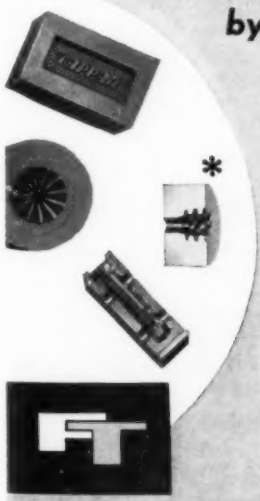
SUBSIDIARY OF ABRASIVE & METAL PRODUCTS CO.

Intricate Plastic Parts easily produced

with BERYLLIUM COPPER PRESSURE CASTINGS by FEDERAL



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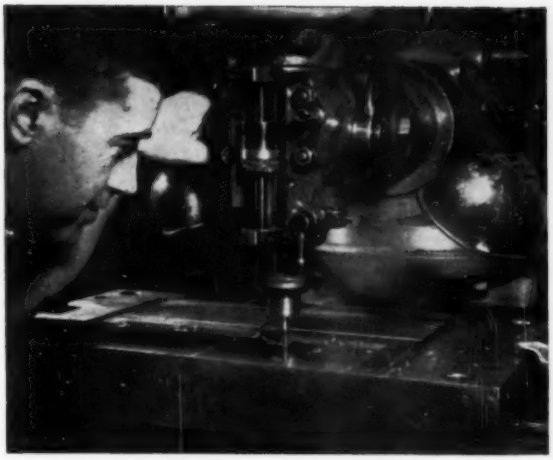

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Mold designers can reduce drawing board time by using D-M-E's full-scale Master layouts, which provide locations of leader pins, return pins, screws and other standard details. Complete catalog specifications and prices on 31 standard sizes—up to $23\frac{3}{4}$" x $35\frac{1}{2}$"—eliminate guess-work in estimating the cost of the mold.

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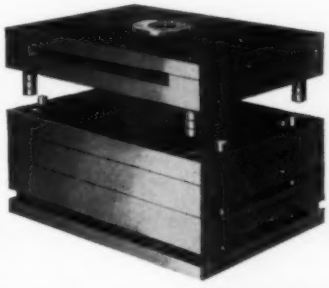

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- excellent chemical resistance
- better yields
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- high impact strength

SEILON PRO also possesses the inertness and water resistance characteristic of a hydrocarbon polymer, as well as excellent electrical properties.

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Plastics Division

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Small skeletons

(*From pp.* 100-101)

respectively, or as a completely assembled unit for $5, including the formed wire supporting stand and tubular transparent acetate display package. The packaging of the molded parts and the accompanying instruction sheet—which includes large front and rear views of a complete human skeleton—is handled on a special line at the Superior Plastics, Inc. plant, where a group of operators loads the intricate components of the skeleton into the package in a smoothly coordinated operation. Finished models are also assembled at the molding plant.

Broader markets opened

Although the Modern Man skeleton model was developed primarily as a study aid for medical students, the great amount of interest stirred by realistic replica soon opened the way to additional sales opportunities. A prominent New York toy retailer convinced the manufacturer that the model could also do an important missionary job among the younger generation, focusing their interest on medicine and related careers. A generation skilled in assembling model aircraft, trains, and cars, it was reasoned, should have no difficulty with miniature skeletons.

As a result, the model was test exhibited at the National Hobby Industry Show in Chicago and at the Toy Fair in New York. Response was so favorable at these showings that the manufacturer now expects to sell some 500,000 of the skeletons this year to the various markets.

The marketing success of this unique miniature skeleton model emphasizes that the sales potential of a given plastics item may be much greater than originally estimated—provided that the product is exposed to a number of different distribution channels. And happily for the producer, unlike many toy and hobby items, the Modern Man skeleton model can never go out of style!

Credit: High-density polyethylene used is Marlex from Phillips Chemical Co., Bartlesville Okla.

A Masterpiece produced by the TRIULZI

Model PL 6/10

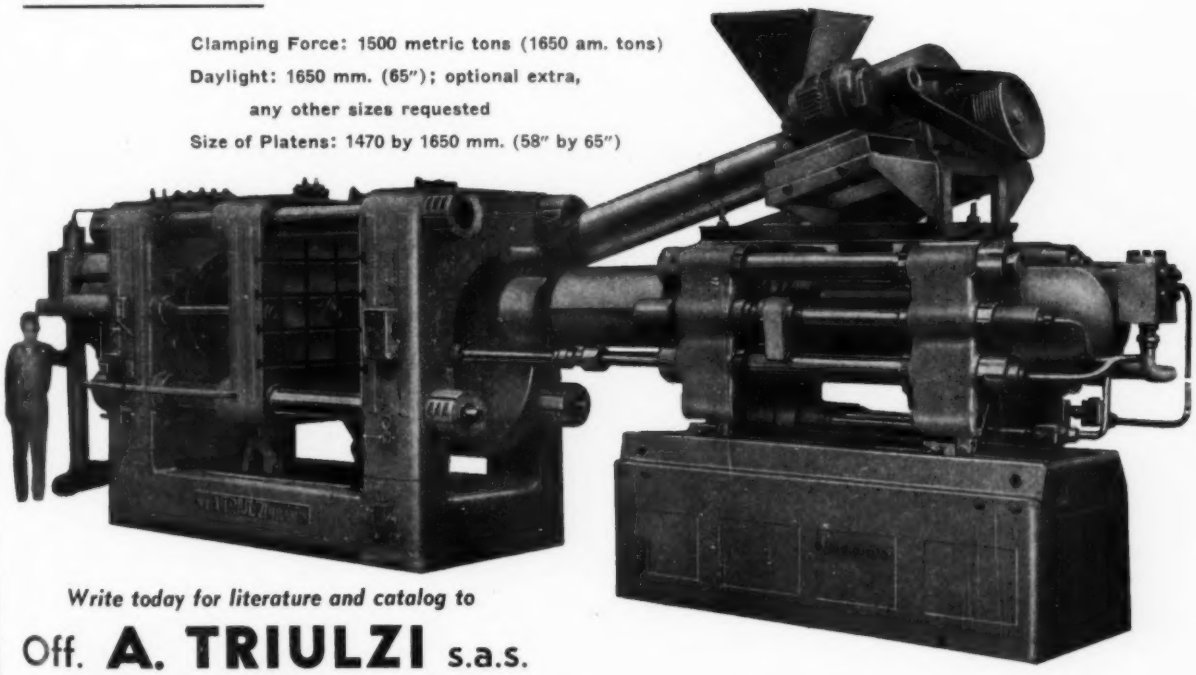
Europe's largest injection molding machine (350 oz.) . . . with preplasticizer and possibility for a wider daylight

PRODUCED FROM LOW PRESSURE POLYETHYLENE

Weight: 8,400 kg. (300 oz.)
Maximum Ø: 750 mm. (30″)
Minimum Ø: 550 mm. (22″)
Maximum Height: 650 mm. (26″)

TRIULZI Model PL 6/10

Clamping Force: 1500 metric tons (1650 am. tons)
Daylight: 1650 mm. (65″); optional extra, any other sizes requested
Size of Platens: 1470 by 1650 mm. (58″ by 65″)



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Beaverton, Michigan

Photocopier

(*From* pp. 108-109)

nize with modern office decor, the Uni-Matic embodies crisp contours, offsets, and other design features which would have been prohibitively costly to reproduce in a drawn metal housing. The cost of draw dies for a stainless steel housing for this unit would have run approximately $20,000. Although this closely parallels the cost of the tools used in compression molding the melamine housing, the big difference lies in the fact that the plastic case is ready for the production line as soon as it is removed from the mold, while a metal case would require further fabricating operations.

The melamine components include the housing proper and a removable cover, held in place by retaining springs, which can be conveniently lifted off to provide access to the developer replenishing tank or other internal parts of the machine. Both these parts are produced by Chicago Molded Products Corp.

Supplementing the melamine housing of the new Uni-Matic photocopier are a number of functional internal plastics components which further reduced production costs, helped to lighten the weight of the finished machine and provided improved operation and maintenance. See tabulation of parts, p. 108.

Three important internal components are injection molded of clear transparent ABS (acrylonitrile butadiene-styrene) resin. They are the replenishing tank, processor tank, and a removable trough which fits the processor tank. Produced by Federal Tool Corp., Chicago, Ill., the replenishing tank is a deep receptacle with cover permanently cemented in place. It is filled through a threaded opening capped by a phenolic closure with leakproof molded polyethylene insert. A "bird feeder"-type valve incorporating a small elastomeric vinyl sealing gasket meters processing solution into the processor tank by gravity as required. The latter tank, and its removable trough, are also produced by Chicago Molded Products. ABS

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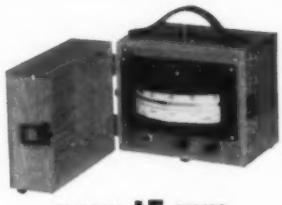

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resin was specified for these parts because it offered high impact properties, was not affected by the developing solution and, in the case of the replenishing tank, permitted visual observation of solution level.

Funtional parts of nylon

Molded nylon gears and pulleys in the operating mechanism of the Uni-Matic copier control the passage of the paper through the processor. Nylon was chosen for these important functional parts because it was less costly than metal, quieter in operation, and required no lubrication. The parts will also wear indefinitely.

Among other molded nylon parts used in the mechanism of the copying machine are two bearings combining a nylon outer race and a metal insert with metal ball bearings, used on the ends of the cylinder retaining shaft. The glass cylinder retained by this shaft encloses the fluorescent tube which serves as a light source for the copying process, and must be held firmly against a neoprene belt in the printer mechanism as it rotates.

Also of nylon are several strain relief clips used on the power cord of the machine and four sleeve bearing inserts used for shafts in the copier mechanism. Additional working parts injection molded of nylon include two rollers and a separator. The latter, a cam-like part molded to critical dimensions, guides and separates the original copy, negative, and print as they are carried through the automatic processing operations. It is made by Mayfair Molded Products Corp., Schiller Park, Ill.

Molded phenolic, offering dimensional stability and electrical insulating properties, finds appropriate use in the switch terminal block and four push buttons which control the operation of the machine. Vinyl spaghetti tubing, in different colors, acts as insulating sleeves over electrical terminals within the machine.

Credits: Melamine, American Cyanamid Co., Plastics and Resins Div., and Plastics and Coal Chemicals Div., Allied Chemical Corp.; Nylon, Du Pont. ABS resin, Bakelite Co. C-11.

Plastics problem got you down?

Get help in a hurry from your Encyclopedia Issue!

EXAMPLE: ***Where and how to use resins and molding compounds?***

1. See the section "Resins and Molding Compounds" for all the fundamentals. Also see the materials charts and supplier lists in the "Technical Data" section.
2. Then check the Advertisers' Index—on the first page of the "Resins . . ." section—for suppliers' ads on resins, coatings, emulsions, etc.
3. Secure additional names and addresses of suppliers from extensive Buyers' Directory lists in the back of the book.
4. Consult the Alphabetic Index for detailed cross-referenced listings of subjects related to your particular inquiry.
5. For more data, mail us the post cards in the enclosed Encyclopedia "How-to-use-it" Guide.

EXAMPLE: ***How to color plastics?***

1. See the section "Chemicals for Plastics" for complete background.
2. Next, refer to the Advertisers' Index on the first page of the section for ads relating to your specific needs.
3. Check the Buyers' Directory for a detailed listing of suppliers of dyes, stabilizers, plasticizers, etc.
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EXAMPLE: ***How to design a product—then get it made?***

1. Get the basic facts in the section "Engineering and Methods".
2. Then for molder and special service advertisements, see the Advertisers' Index on the section's first page.
3. Next, examine the Buyers' Directory for additional names and addresses of molders, extruders and service organizations.
4. Consult the Alphabetic Index for detailed cross-referenced listings of subjects related to your particular inquiry.
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EXAMPLE: ***Which machinery to buy?***

1. Turn to the section "Machinery and Equipment" for a complete picture of the factors involved.
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The Encyclopedia is expressly designed to help you solve your problems. Reach for it next time you need help and see how valuable it can really be!

MODERN PLASTICS ENCYCLOPEDIA ISSUE

. . . for fast, accurate answers to plastics problems

Designing stiffness

(*From pp. 123-132*)

equal in stiffness to a solid aluminum beam of the same depth and width. Aluminum has a modulus of elasticity of 10,000,000 p.s.i. and consequently,

$$I_{aluminum} = \frac{bt^3}{12}$$

$$EI_{aluminum} = 833{,}000\ bt^3$$

The contribution to the modulus that must be made by the foil is the difference of the EI products; that is,

$$EI_{steel} = EI_{aluminum} - EI_{plastic} = 808{,}000\ bt^3$$

The mean distance of the foil from the neutral axis is

$$\frac{T+t}{2}$$

$$I_{steel} = 2\ bT\ \frac{(T+t)^2}{2} + \frac{2\ bT^3}{12}$$

$$EI_{steel} = 15{,}000{,}000\ bT\ (T^2+2\ Tt+t^2) + \frac{bT^3}{3}$$

Since T will be much smaller than t,

$$EI_{steel} = 15{,}000{,}000\ bT^2$$

very nearly. But this must also be equal to 808,000 bt^3. Therefore T must be equal to 0.054t. It follows that an increase of only 10.8% in thickness will result in an increase in EI product to that of aluminum. For the bar of Fig. 17, since $t = 0.040$ in., $T = 0.054 \times 0.040 = 0.002$ inch.

Assuming a density of 1.2 for the plastic and 7.9 for the steel, the effective density of the combination is about 1.8, which is lower than any structural metal except magnesium. Provided that the bond in shear between the foils and the plastic is sufficiently strong, the part will perform as well (at room temperature) as an aluminum section. Assuming that the foil has a tensile strength of the order of 100,000 p.s.i. and the bond in shear is of the order of 4000 p.s.i., it can be shown that an aluminum section of tensile 20,000 p.s.i. will fail in flexure before the foil laminate.

Since there are known structural adhesives such as the epoxy-based materials capable of producing shear strengths of this order of magnitude, such structural members are possible and in fact have been made. It is possible by the coating of a plastics part with a thin high-modulus metal foil to make it comparable in flexural stiffness and flexural strength to an aluminum part of the same size, with the composite weighing only ¾ as much as the aluminum piece.

It should be clear that with a little ingenuity the designer can create readily molded and fabricated parts out of plastics which will equal the flexural performance of their counterparts in the older structural materials at little or no penalty by the use of extra material or greater difficulty of manufacture.

The technique that is discussed here should pave the way for a host of new applications and uses for the wide range of excellent materials now available to the plastics industry.—END

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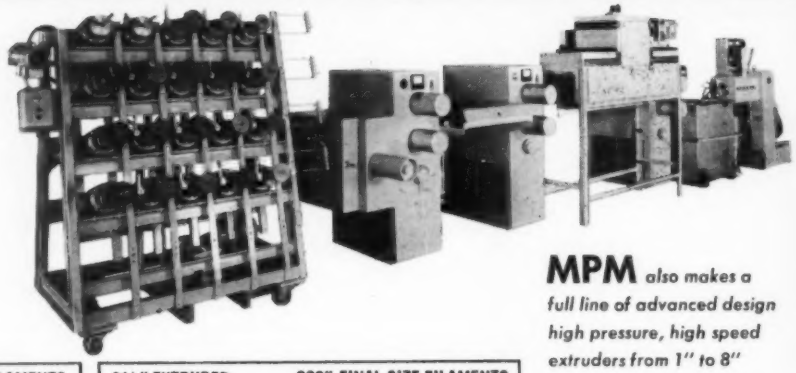

1½" EXTRUDER	.010" FINAL SIZE FILAMENTS		
NO. OF FILAMENTS	20	40	50
WIND-UP SPEED/FPM	600	320	265
LBS/HR	22.5	25	25

2½" EXTRUDER	.020" FINAL SIZE FILAMENTS		
NO. OF FILAMENTS	20	40	50
WIND-UP SPEED/FPM	530	265	210
LBS/HR	80	80	80

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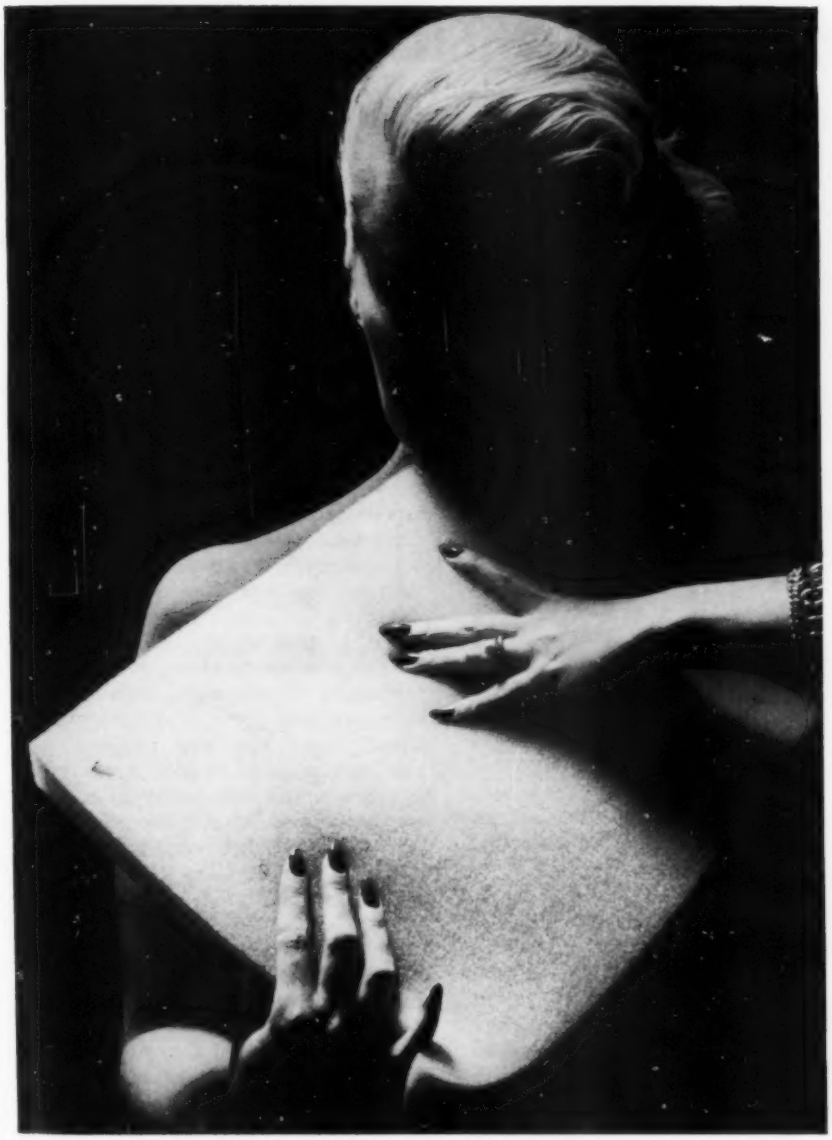

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- **Densities as low as 1.5 lb. per cu. ft.**
- **RMA compressions down to 8 lbs. where desired.**
- **Fast cure cycle.**
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- **No prepolymer preparation.**
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● **SELECTROFOAM Resins** are also available in tough, non-friable rigid types. These can be used to make inserts or fillers in structural tubing or channels, as laminates for various kinds of wall construction, in refrigeration wall panels and doors, trailers, airplanes and in other structures where great strength and thermal and acoustical properties are required.

● **For complete technical details** and field information on all types of SELECTROFOAM Resins write Pittsburgh Plate Glass Company, Plastics Department, 1 Gateway Center, Pittsburgh, Pa.

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The Plastiscope

News and interpretations of the news
By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 39)*

Reports from Russia

Now that several representatives from the U. S. plastics and chemicals industries have returned from a tour of Russian plants and research institutes, it is a little easier to put into perspective Premier Khrushchev's recent comments on Russia's plastics industry. In a report to the Central Committee of the Communist Party of the Soviet Union, Khrushchev stated: "In spite of the generally high level of the development of the science of chemistry in the U.S.S.R., there still exists a considerable lag in certain areas. This is primarily applicable to the field of artificial and synthetic fibers and plastics," he explained.

Reporting on his recent trip to Russia, Dr. Herman F. Mark, leading polymer scientist and a staff consultant to Foster Grant Co., Inc., Leominster, Mass., stated that production of all types of polymers in Russia is 20 to 30% of the corresponding production in the United States, and research in the field is 30 to 40% of that in the United States. Dr. Mark also reported that polyethylene production in the U.S.S.R. is 120 million lb. annually; polystyrene, 90 million lb.; and polyvinyl production, 100 million pounds. (See also Dr. Mark's article "Soviet polymer science today," MODERN PLASTICS, July 1958, p. 111.)

Seven-year program. However, under a new seven-year program, the Russians hope to increase commercial production of plastics eightfold. This apparently is being done as one of the fastest and most economical means available of showing the Russian people and, of course, the rest of the world some tangible evidence of an improved standard of living, Dr. Mark commented.

Dr. Mark felt that the principal obstacle to increased production under the seven-year program is the lack of technically trained people, although their education has been accelerated by all conceivable means.

The Russians are turning out linear polyethylene, polypropylene synthetic fiber, and polycarbonate plastics, materials which are just getting a foothold in the United States, but Dr. Mark pointed out that "nowhere, however, did I see a material, a method, or an approach which was not known to me in principle either from our own work or from technical literature." He reported also that the Russians borrowed freely—and usually without acknowledgment—from patented technical processes of other nations and did not adhere to the international Geneva Convention patent agreements that are now in effect.

According to Dr. Mark, the Russians have developed a type of nylon based on ethylene, instead of the more commonly used benzene, and are making a good fiber from it. He also said they have a fluorine-based fiber used mainly for insulating wire for high temperature uses.

Expansion of chemicals and plastics. A leading Soviet polymer scientist, Dr. S. E. Bresler of the Institute of Macromolecular Compounds, Leningrad, who attended this year's Gordon Research Conference on Polymers in New Hampshire, also revealed some aspects of present and future activities in Russia's plastics industry. More than 100 billion rubles ($10 to $20 billion) will be invested by the Soviets in the expansion of chemicals and plastics raw materials, such as ethylene and propylene, and other monomers derived from petroleum and gas, Dr. Bresler reported.

Russian polyethylene. At the present time, the Russian scientist admitted that polyethylene is produced only for industrial purposes. Wide-scale use, such as the manufacture of squeeze bottles and other consumer items, has not developed as it has in the United States. One of the objectives of the expansion program is to fulfill such mass consumption needs, according to Dr. Bresler. He also stated that polypropylene is being produced only in pilot plant quantities. However, sizable tonnages of caprolactam-type nylon are being produced in Russia, he said.

An eight-man U. S. plastics industry team also visited Russia recently, and a report issued by The Society of the Plastics Industry, Inc., highlights the team's observations on Russian plants and processes.

The compression molding that the team saw was more impressive than the injection molding, which is understandable, since Russian emphasis has been on the production of industrial rather than consumer goods. The S.P.I. reports that the compression molding factories visited were equipped with batteries of hydraulic presses ranging in size from 100 to 2000 tons rated pressure. The smallest plant that the team saw contained approximately 150 such presses.

Tool-making facilities in at least one of the plants visited were excellent, judging from the complexity and quality of molded products, it is reported. One member of the team also stated that injection molding appears to be slow in the Soviet Union—probably at half the present rate of the United States. He also stated that the quality of laminations was unusually poor.

Plastics production. The Soviet Chemical Ministry supplied the following production figures of

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A strong, quick-drying, exceptionally fast-grabbing, "non-dimpling" foam-splicing adhesive. Incorporates new synthetic polymer which permits swift application of minimum glue line thicknesses without "bare spot" hazards. Resultant seams are softer than has been possible up to now, yet the bonds are stronger than the foam or sponge.

This ability to apply such extremely thin glue lines also results in: greater yield-per-gallon (thereby lowering materials costs); faster "grab" (leading to increased production speed); avoidance of "dimpling" (which represents the most serious hazard in foam cushion manufacture).

Used for soft-seam bonding all foams to themselves and *to each other* . . . and for cementing fillers, boxing, and crowning.

SPECIFICATIONS

VISCOSITY: 600-1,000 cps; COLOR: clear, pale yellowish; BASE: synthetic elastomer; SOLVENT (dilution or cleanup): toluol; TACK LIFE: up to 15 minutes; WEIGHT PER GALLON: approx. 6.8 lbs; SOLIDS: 14-16% by weight; ODOR: non-residual; STORAGE: 1 year.

APPLICATION

Using brush, spray gun, or roller, apply thin coat to each surface to be bonded. Air dry briefly and gently press surfaces together. A firm bond results at once.

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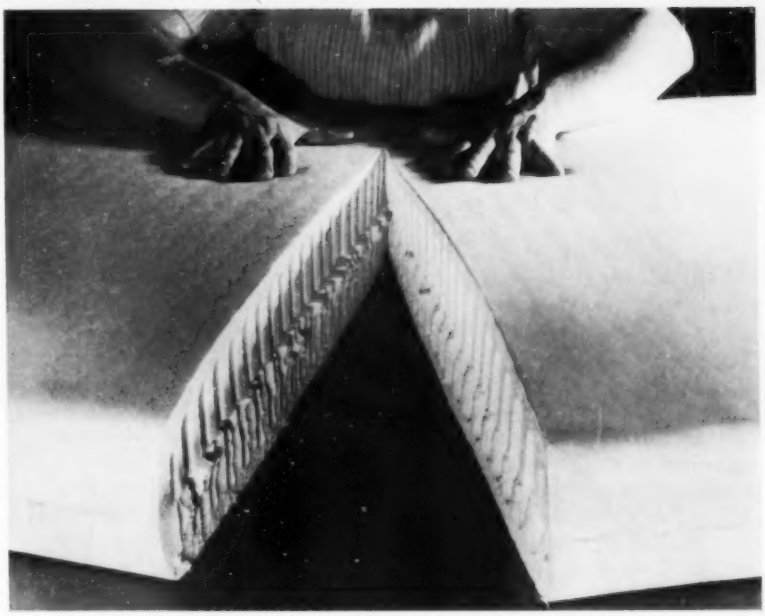

Either or both of the slabs shown above could just as well have been polyurethane foam as far as our unique new BONDMASTER R275 is concerned. You'd enjoy the same:

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- Thinner glue lines than ever before possible
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- "Foam-tearing", stronger bonds

. . . than with any other non-dimpling adhesive you've ever before tested for either rubber or urethane foams. This new formulation handles *both* foams with equal ease and effectiveness.

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If your product involves the bonding of flexible foams to themselves or to each other, it will pay you to investigate the time-, labor-, and cost-savings that BONDMASTER R275 can bring to your production. We'll be glad to send a sample if you mail your request on your business letterhead.

The Plastiscope

plastics materials produced in Russia for 1957:

Resin	*Production (in 1000 lb.)*
Phenolics and other tar acid resins	143,300
Epoxies and alkyds	64,375
Silicones	4,850
Urea and melamines	118,609
Caprolactam-nylon	28,219
Fluorocarbon and related materials	44,092
Thermoplastics—all types	133,380
TOTAL	536,825

Photopolymer printing plates

Field evaluation of Du Pont's experimental photopolymer (photosensitive plastic) printing plates is under way in book, commercial, business form, periodical, and packaging printing plants. Field testing in newspaper color work will also be conducted; some spot tests in regular newspaper printing were made last year.

A comprehensive report on the experimental photopolymer plates, including field testing data and a plate-making demonstration, will be presented September 27 in New York at an all-day letterpress forum sponsored by the Printing Industry of America, International Association of Printing House Craftsmen, and the Research and Engineering Council of the Graphic Arts Industry.

The expected date of commercial availability of photopolymer printing plates is late 1960.

PVC cable jacketing

A tougher and lighter extruded tubing for jacketing coaxial, umbilical, and other cables is being produced by Borden Chemical Co., Resinite Dept., at plants in North Andover, Mass., and Santa Barbara, Calif. Known as Resinite EP-145, the new PVC material is described as an improved equivalent of Specification MIL-R-6855, Class II, Grade 60, synthetic rubber.

EP-145 is said to have from 11 to 31 times the abrasion resistance of neoprene at various test cycles and, in actual use, is considerably lighter than neoprene because its superior properties permit thinner walls and use of less material. According to the manufacturer, the material does not deteriorate from exposure.

The material is claimed to remain flexible at temperatures below —100° F. Flame-resistant and self-extinguishing, the tubing also surpasses requirements for hot-air aging and hot oil and hot water immersions.

EP-145 is available in red and black, from ¼ to 1½ in. inside diameter.

More PVC resins gain UL approval

Polyvinyl chloride resins from various manufacturers have recently been added to the Underwriters' Laboratories' interchangeability list for electrical applications.

Escambia Chemical Corp., New York, N. Y., now offers four approved resins for extrusion, calendering, and molding of electrical products. In order of their molecular weight (highest to lowest), the company's approved resins are: Escambia PVC 1250-E; 1225-E, 1200-E, and 1185-E.

Interchangeability with all other approved PVC resins has also been extended to Trulon 500 PVC resin, manufactured by Thompson Chemical Co., Pawtucket, R. I.

Trulon 500 is being used in large quantities in many vinyl applications, according to Thompson. It is said to be a uniform gel-free product, giving high rates of extrusion with a glossy, smooth surface from either dry blends or granules.

Thompson is one of the various new producers of vinyl chloride resins that came into production last year. This is the firm's first announcement concerning availability of material. Apparently the company is concentrating on production of wire coating resins but also has available a general-purpose resin for more widespread distribution to the trade.

Kohinor 652, a dry blending vinyl chloride resin manufactured by Eleonora Chemical Div., The Pantasote Co., New York, N. Y., has also been recognized by UL as an interchangeable basic resin. Kohinor 652 has been widely used in the calendering and extrusion field, the company states.

UL also announced approval of Eleonora's Kohinor W-200 compound for types T, TW, 60° C., and 80° C. insulation.

New phenolic cheaper

Trimethylolphenol, a new phenolic monomer produced by Bakelite Co., Div. of Union Carbide Corp., has been reduced in price by 40%, from 35 to 21¢/lb. in truckload quantities. Marketed as a 70% aqueous solution, and designated BRLA-1030, the material is now available from the company's Bound Brook, N. J., plant.

Present and potential uses for BRLA-1030 are in the production of thermal insulation, coatings and adhesives, electrical grade laminates, etc. Field tests are said to indicate that the new material can be blended with inexpensive extenders like corn sirup with no measurable loss of phenolic properties.

A single chemical species, the material is reported to present significant advantages over previous water-soluble phenolic resins that are not monomeric. These properties include high methylol content that promotes condensation with carbohydrates and amines and practically unlimited dilutability even when acidified with strong mineral acids. Other important characteristics of the new material are said to include good adhesion to glass when cured, and good penetration into cellulose; low viscosity, measuring 60 to 85 cp. at 25° C.; low ash content; and known molecular structure. The aging properties of this heat-reactive phenolic are

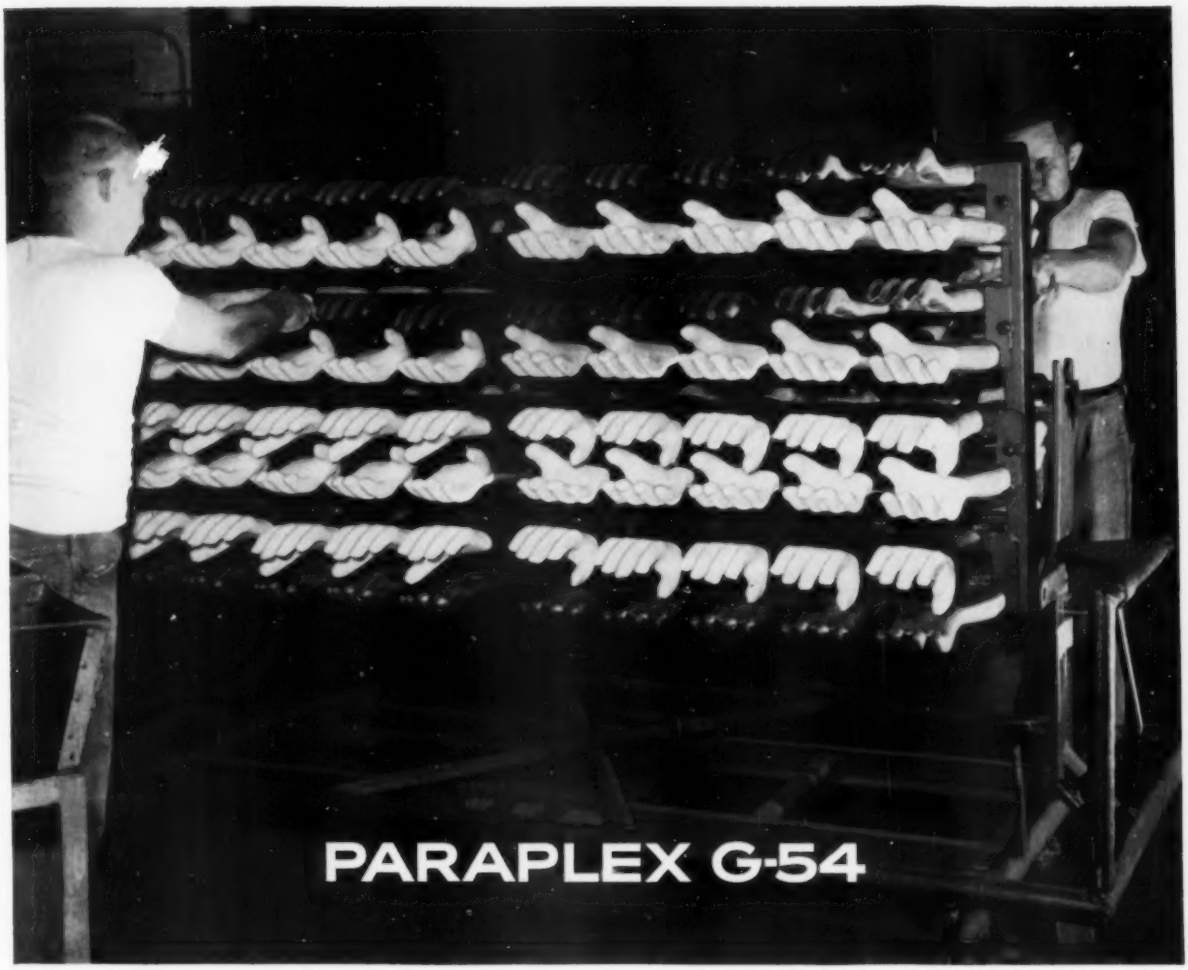

Photo courtesy Edmont Manufacturing Company, Coshocton, Ohio

For grease and solvent resistance in vinyl compounds...

Hot water, soap and detergents, solvents, greases, corrosive materials and abrasives are only a few of the hazards that industrial gloves must withstand to meet service requirements. That's why formulators of vinyl compounds for tough jobs choose PARAPLEX G-54—the polymeric plasticizer that's designed for rough, tough service.

Whether you are making plastisols for dip coating or are interested in gaskets, surgical tapes, high-temperature resistant electrical insulation or general utility vinyl compounds, PARAPLEX G-54 is the best answer to your problem. Check your needs against these outstanding properties that PARAPLEX G-54 gives to vinyl compounds:

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PARAPLEX G-54

The Plastiscope

claimed to be better than those of most water-soluble resins. BRLA-1030 will retain its dilutability for several months in cold storage, according to the company. Like most phenolic solutions, this new monomer is dark red in color.

Chemical reactivity of the methylol groups makes the material useful as a cross-linking agent for compounds of polymers containing active hydrogens. According to the company, new plastic alloys have been obtained by adding BRLA-1030 to urea, melamine, polyhydroxy compounds, phenol, substituted phenols, two-step phenolic resins, resorcinol, and aniline.

Specifications approved

The following specifications have been approved and printed: MIL-M-3412A, Molding Plastic, Ethyl Cellulose; MIL-P-14118, Plastic, Cellulose Acetate, Sheets and Film; MIL-M-21347, Molding Plastic, Polystyrene, Glass Filled; L-M-500, Molding Plastic, Acrylic; and L-M-520, Molding Plastic, Polystyrene.

The Ordnance Materials Research Office has announced that these specifications will require prior qualification testing of the material and that manufacturers should take prompt action concerning qualification testing of the products they wish to offer for Government procurement.

Information on the submission procedure may be obtained from Commanding Officer, Picatinny Arsenal, Dover, N. J., Attention: Plastics and Adhesives Laboratory.

Vinyl acetate-vinyl stearate copolymer

Last month MODERN PLASTICS announced that the new Air Reduction Co.'s plant for production of vinyl stearate was ready to go on stream. Included in the article were suggested uses for the material. However, the point was overlooked that Colton Chemical Co., a division of Air Reduction Co., has been in production of Flexbond vinyl acetate-vinyl stearate copolymer emulsions and beads for some time and recently reduced prices from 18 to 33% in nine grades that heretofore have been available in pilot plant quantities only.

The film properties of vinyl acetate-vinyl stearate copolymer emulsions exhibit such desirable characteristics as grease and water resistance, non-toxicity, permanent flexibility, heat sealability, excellent adhesion, and transparency. These emulsions are used in paper coatings, food packaging film, textile and leather finishes and coatings, adhesives, and paint.

Vinyl acetate-vinyl stearate copolymer beads are soluble in benzene, toluene, methyl acetate, carbon tetrachloride, and other common solvents. The lower stearate content beads tolerate significant quantities of the lower alcohols.

High-temperature phenolic laminating resin

Laminated parts for missiles and rockets, made from a new phenolic resin manufactured by Reichhold Chemicals, Inc., White Plains, N. Y., are reported to withstand up to 4500° F. for brief periods and up to 500° F. for 100 hr. and longer.

Designated Plyophen 5900, the resin is said to produce laminates having not only high strengths at elevated temperatures, but also low moisture absorption, good insulation properties, and good resistance to organic solvents, weak inorganic acids, hydraulic aircraft oil, de-icing fluids, and hot gas erosion.

Reinforced with glass cloth or asbestos, the resin will be used for nose-cone sections, skin strengtheners, internal hoops, electronic equipment mountings, and other missile and rocket parts.

Plyophen 5900 is claimed to be suitable for either low-pressure or high-pressure lamination. According to the company, low-pressure laminates made with the new resin exhibit better properties than those obtained at high pressures with some earlier resins of this type.

Polyethylene reinforces rubber

The addition of Marlex high-density polyethylene to rubber gives a greater degree of reinforcement than either high styrene resin or conventional polyethylene, according to a research report issued by Phillips Petroleum Co., Bartlesville, Okla., producer of Marlex.

Initial studies of rubber-Marlex blends indicated there was considerable improvement in tensile strength and gas impermeability compared with stocks containing conventional polyethylene, Phillips states. Research is also said to have indicated that this blend would improve resistance to solvents and should develop improved dent- and scuff-resistance in floor tile.

Although gum stocks with high styrene resin gave stress-strain properties similar to those of the Marlex-reinforced formulations, the latter are claimed to have had a lower heat build-up and hydrogen permeability.

Commercial applications in footwear, gaskets, floor tiling, mechanical rubber goods, and blown sponge are expected to develop from these research findings, according to Phillips.

Mylar for cables

Use of 1-mil Mylar polyester film, type A, to replace certain materials in building wire and service entrance cable, has been approved by Underwriters' Laboratories, according to Du Pont.

In the building wire application, a 1-mil tape of Mylar has been approved for use over previously vulcanized rubber insulation and under an asphalt-pitch impregnated cotton braid in cables No. 8 AWG and larger, which are produced in continuous vulcanizers. In this application, Mylar replaces a rubber-filled cotton tape.

In the service entrance cable application, approval was granted

U.S.I.

Vol. III, No. 4

POLYETHYLENE PROCESSING TIPS

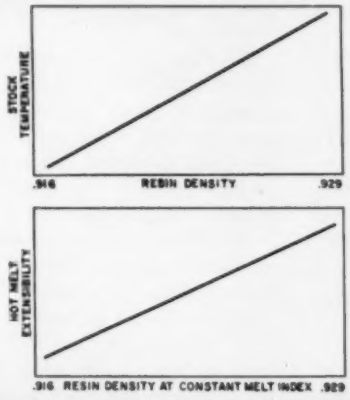
HOW RESIN DENSITY AFFECTS FILM PROPERTIES, EXTRUSION CONDITIONS

Extruders of blown or flat film will find, in working with some of the newer polyethylene resins of about .93 density, that they are significantly different from the more conventional resins of about .92 density – both in behavior during processing and in properties of the final film.

Operating Temperatures and Speeds Rise

As resin density increases from .916 to .930, higher stock temperatures are required – ranging from zero to 30°F higher, depending on the resin. At the same time, blown film does not have to be cooled as much. Since the higher density resins have a harder surface, are less tacky, and do not block readily, the temperature of a film of .930 density resin can be 10-20°F higher at the nip rolls of the take-up without introducing internal blocking.

The higher film temperatures at the pinch rolls help prevent wind-up wrinkling to which higher density films are susceptible (see U.S.I. Polyethylene Processing Tips, Vol. III, No. 3). Less cooling means faster production using higher density resins, and is also advantageous when space for cooling equipment is limited.



It should be remembered, in processing higher density resins, that the resulting films have lower impact strength than do films from lower density resins. Therefore, excessive roll pressures in blown film wind-up should be avoided, to prevent too sharp a crease in the flattened film cylinder, particularly in gussetted film. A sharp crease, when subjected to impact loading during film use, will frequently fail by tearing.

Also, as density increases from .916 to .930, resins have better hot melt extensibility – can be drawn down to thinner gauges. U.S.I.'s .929 density resin, for example, has been drawn down to less than 0.2 mils thickness in a regular production run.

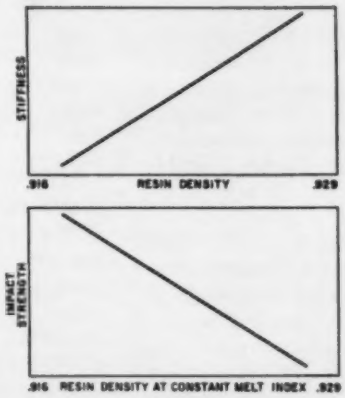
Films are Stiffer, Easier to Handle: Seal Hotter

Films extruded from higher density resins have more body and less stretch than do those made from conventional resins. This means that they are easier to handle on standard converting equipment and can be more easily used on high-speed converting and packaging machinery.

In heat sealing, as in extrusion, slightly higher temperatures must be used to effect a satisfactory seal with the higher density resins.

Clarity Up, Impact Strength Down

At resin densities of about .93, films are clearer, have less haze, higher gloss, greater transparency. They are stiffer, with more tensile strength, but have lower impact tear and impact strengths. Because they have harder surfaces, they are more abrasion-resistant. Heat resistance also increases. Permeability goes down (see U.S.I. Polyethylene Processing Tips, Vol. II, No. 2).



As you can see, the extruder's choice of resin density will depend largely on the film properties desired by his customer. For toughness, flexibility and good protection, low densities are indicated. For more stiffness, clarity and heat resistance, higher densities are coming into prominence.

U.S.I. offers a series of polyethylene resins, ranging in density from .916 to .929. U.S.I. technical service engineers can recommend the proper resin with the best balance of properties for your particular application. They will be glad to work with extruders and converters on processing problems as well.

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Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N.Y.
Branches in principal cities

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for use of 1-mil Mylar over the stranded neutral conductors and under the outer braid when type RHW (heat- and moisture-resistant) insulation is used on the insulated conductor.

According to Du Pont, Underwriters' Laboratories has indicated it will extend approval to any manufacturer using constructions similar to those described, upon application.

IDI awards

Plastics scored a triple triumph in the annual design competition sponsored by the Industrial Designers Institute. All three products cited for awards are composed largely or primarily of plastics.

Melvin H. Boldt, ASID, Chicago, Ill., received a citation and medal for the design of the AMI portable washer for AMI, Inc. This appliance is virtually all plastic, except the motor, incorporating melamine, phenolic, nylon, and epoxy components. (see "Plastics Make Portable Washer Possible," MODERN PLASTICS, May 1958, p. 105.)

S. M. Highberger, Harley Earl, Inc., Detroit, Mich., received similar recognition for the design of the "Secretary" model Thermo-Fax copying machine produced by Zenith Plastics Div., Minnesota Mining & Mfg. Co., Gardena, Calif. The housing of this unit is composed essentially of glass-reinforced polyester material.

The third award winner was Eero Saarinen, Eero Saarinen Associates, for the design of the Pedestal Group of furniture for Knoll Associates, Inc. (see MODERN PLASTICS, June 1958, p. 115.) Included in this group is a glass-reinforced plastics swivel chair having a plastic-coated base.

Wider polystyrene sheet

High-impact polystyrene sheet in widths up to 60 in., in high gloss or matte finish, is now available from Auburn Plastics, Inc., Auburn, N. Y. The material can be custom extruded in any length up to 3/16 in. thick in any color, and also may be painted before or after forming.

Phenolic for neoprene adhesive

A new heat-reactive phenolic resin for use in neoprene adhesives has been developed by Schenectady Varnish Co., Inc., Schenectady, N. Y. Designated SP-126, the resin is claimed to make possible the production of solvent-type neoprene adhesives with high heat resistance. The material is also said to possess fast air-drying and good cohesive as well as adhesive properties.

Soluble in aromatic, aliphatic, and ketone solvents, SP-126 is said to be compatible with both neoprene and nitrile rubber. It is produced in lump form and has a melting point of 145 to 165° F. An adhesive is made by mixing together solvent, premilled rubber, and the resin, or by milling the resin in the rubber stock before cold cutting with solvent.

Neoprene solvent adhesives containing SP-126 resin are reported to be useful for bonding glass, steel, and non-porous surfaces to themselves or to each other. For all-purpose neoprene adhesives, where high heat resistance is not required, a companion resin, Schenectady SP-560 terpene phenolic, is used because of its lower cost.

Guarantees styrene against discoloration

Styrene components for lighting fixtures and illuminated ceilings are now guaranteed against ultra-violet light discoloration by Sheffield Plastics, Inc., Sheffield, Mass., the manufacturer.

The company's extruded diffusers and sheets for vacuum forming are produced with Frost-White-X, a modified styrene coated with a protective layer of a special ultra-violet absorbing agent. The coating and its method of application to a special grade of high-impact styrene were developed by Sheffield engineers. According to the company, Frost-White-X makes possible the production of fluorescent lighting shields and pans which combine the economy, flexibility, and toughness of high-impact styrene with extreme light stability even though exposed for long periods to ultra-violet light given off by fluorescent lamps.

The new material also has a non-reflecting surface finish which prevents eye-straining reflections. Despite their combination of properties, it is claimed that shields and pans made with Frost-White-X show no sacrifice of cold flow properties or dimensional stability.

The coating itself is applied in such a fashion that it is permanently combined with the material, cannot be removed by normal cleaning methods, and will not wear off with aging, Sheffield asserts.

New thermoplastic films

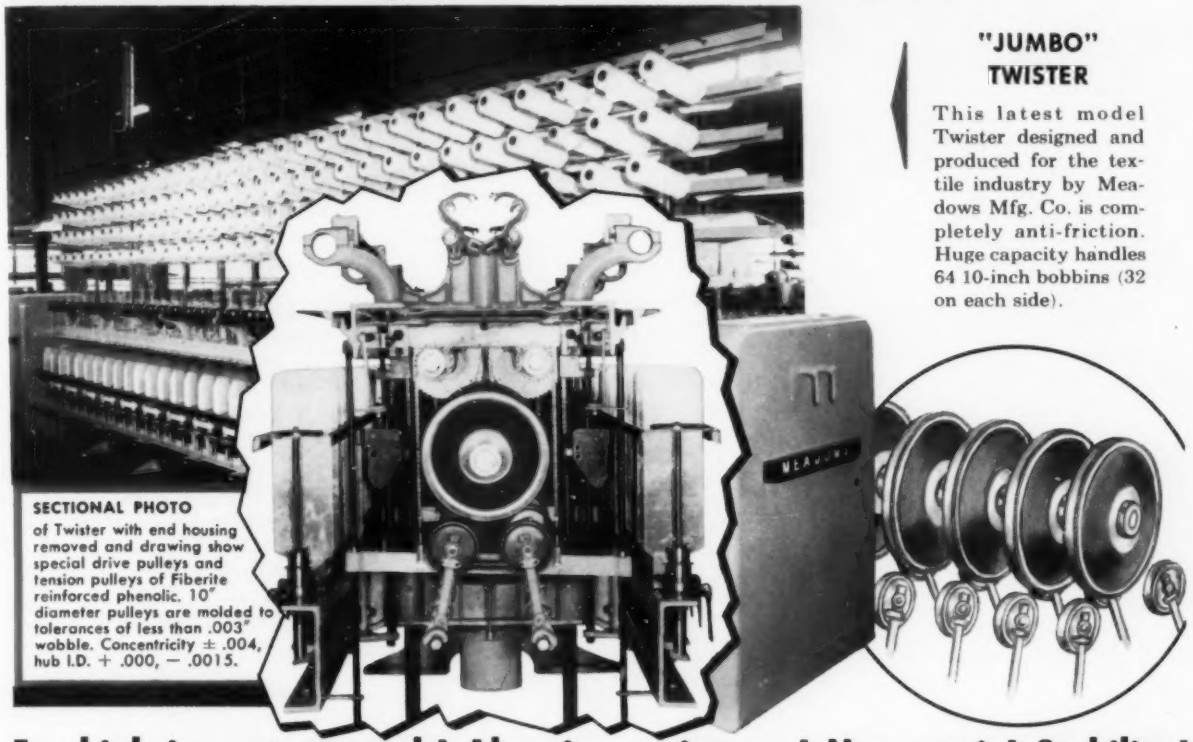
Availability of several new unsupported thermoplastic films made by new processing techniques has been announced by Ludlow Papers, Inc., Needham Heights, Mass., marking the company's full scale entry into the film market.

The new films are called Proplene, made from Pro-fax polypropylene resin; Caplene, made from nylon-6 resin; and Orthofoam and Metafoam, foamed films made from low- and medium-density polyethylenes, respectively. These new products are reported to be the first of their kind available on a volume basis.

Ludlow claims its new process, called Flex-L, produces: 1) outstanding clarity and gloss in all thermoplastic films; 2) improvement of properties through biaxial orientation; and 3) formation of products at optimum crystallinity. The process is also stated to convert conventional, medium, and higher density polyethylenes to clear and glossy films.

It is indicated that Proplene polypropylene film will offer competition to polymer-coated cellophanes, saran, the medium- and higher-density polyethylenes, and some vinyls. It is re-

Another example of FIBERITE at work...



SECTIONAL PHOTO
of Twister with end housing removed and drawing show special drive pulleys and tension pulleys of Fiberite reinforced phenolic. 10" diameter pulleys are molded to tolerances of less than .003" wobble. Concentricity ± .004, hub I.D. + .000, − .0015.

"JUMBO" TWISTER

This latest model Twister designed and produced for the textile industry by Meadows Mfg. Co. is completely anti-friction. Huge capacity handles 64 10-inch bobbins (32 on each side).

For high impact strength! Abrasive resistance! Non-static! Stability!

LEADING TEXTILE MACHINE MAKER SPECIFIES FIBERITE

For up-to-the-minute, high production machinery the textile industry calls on Meadows Mfg. Co. of Atlanta. Special features of Meadows' machinery, such as the new "Jumbo" Twister shown above, include individual FIBERITE drives (formerly all drives were from long cylinder sections of steel construction). The FIBERITE material features high impact strength . . . wear resistance . . . corrosion resistance . . . non-slip . . . ease of molding . . . excellent dimensional stability . . . light weight.

Meadows designs their own pulley molds and molds pulleys in a wide variety of sizes for their own and for competitive machines.

"We have been using Fiberite material for more than 10 years," reports Mr. E. D. Meadows, President, "and we have found it very satisfactory."

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CHICAGO OFFICE: Railway Exchange Building, Michigan Ave. at Jackson Blvd., HA. 7-1164
WESTERN OFFICE: Riverdale Plastics, 8510 Warner Drive, Culver City, Calif., TE. 0-7733
CANADA: The Bakelite Co., 40 St. Clair Ave. E., Toronto 7, Ontario

PRODUCT DESIGNER, MANUFACTURER, MOLDER: The Meadows Mfg. Co., Atlanta, Ga.

MOLDING COMPOUND: A cotton reinforced phenolic specially formulated for Meadows.

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The Plastiscope

ported suitable for processing not only on overwrap and bag impulse-sealing machines, but also to perform well in blister and skin-type packaging.

Caplene caprolactam-based film is expected to be competitive in the polyester film field. It is reported to have the advantages of heat sealability; grease, oil, and flavor resistance; and to be self-extinguishing.

Foamed polyolefin sheeting offers an entirely new medium for designers in several fields. Made of flexible, translucent, textured material, in colors and natural, Orthofoam and Metafoam reportedly will compete with foil, plastic laminates, and the higher grades of paperboard in moisture barriers, insulating applications, and thermoforming uses.

Other new Ludlow products include high-, medium-, and low-density polyethylene films known as Paraplene, Metaplene and Orthoplene, respectively. All of Ludlow's new plastics films are presently available in widths up to 5 feet.

Polyethylene lining

A new process of applying polyethylene to steel surfaces for lining tanks, pipe, and valves has been developed by Tank Lining Corp., 246 Washington Rd., Pittsburgh 16, Pa., and will be offered under license to other lining companies.

The company's method involves a special preparation of the steel surface and the spraying on of a high-molecular-weight, high-density, low-pressure type polyethylene, followed by a carefully controlled heat treating process.

The company does not itself manufacture or sell coatings but is experienced in the application of liquid and sprayable lining materials. Tank Lining expects the sprayed polyethylene lining to supplant sheet lining in many instances. It is reported to be useful in storage tanks up to 150,000-gal. size, railroad tank cars, tank trucks, chemical processing equipment, duct work, etc., and even barges and seagoing tankers.

The low cost of polyethylene is expected to make the lining particularly attractive to companies in the chemical processing field.

Plastic pipe fabrication taught

A special trade school for instructors in the properties and fabrication of plastic pipe has been established by The General Tire & Rubber Co.'s Bolta Products Div., Lawrence, Mass., in cooperation with the United Association of Plumbers and Steamfitters and the U. S. Department of Labor's Bureau of Apprenticeship and Training. The school is designed to provide its pupils with the basic knowledge and technical proficiency to teach proper fabrication techniques to the installing trades.

All classroom and workshop space, as well as material, equipment, and laboratory facilities, are furnished by Bolta without charge. Local Joint Apprenticeship Committees provide traveling and living expenses for their instructors during the five-day course, which includes lecture periods and manual training.

Details on future courses for instructors may be obtained from Bolta or from the Apprenticeship Coordinator, United Association of Journeymen and Apprentices of the Plumbing and Pipe-fitting Industry, Ring Bldg., 1200 18th St., N.W., Washington 6, D. C.

Informative Labeling Contest

Manufacturers of all types of plastics consumer products are invited to compete in the Fourth Annual Informative Labeling Contest of The Society of the Plastics Industry, Inc.

Products, accompanied by entry blanks, labels, hang tags, inserts, and packaging, should be forwarded to The Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y. Entry blanks may be obtained from the S.P.I. All entries, to be eligible for judging and awards, must be postmarked no later than October 26, 1958.

Awards will be made in the following product categories: apparel, building materials, floor and wall coverings, hardware, home furnishings, housewares, notions, toys, and miscellaneous. From winners in these categories, a grand award for "Best in Show" will be selected.

The awards will be presented at the Eighth National Plastics Exposition and S.P.I. Annual National Conference in Chicago, Ill., November 17 to 21.

PVA emulsions reduced

A price reduction of 5¢/lb. across-the-board for its spray-dried polyvinyl acetate emulsions, Resin D-700 and D-702, has been announced by Shawinigan Resins Corp., Springfield, Mass.

The truck load price is now 47¢/lb., while the under 200-lb. price drops to 52 cents.

Plastic pavement

The heavily traveled San Francisco-Oakland Bay Bridge has a new safety pavement made of Guardkote, an epoxy paving resin developed by Shell Chemical Corp., 50 W. 50th St., New York, N. Y. The pavement resists skidding even when wet and is said to stop cars in one-half to three-quarters of the distance required by cars stopping on concrete.

Guardkote is poured on a conventional road surface—either concrete or asphalt—and covered with grit as it begins to harden. The result is a thin, sand-like coating which sticks firmly to the road.

According to G. W. Huldrum, Jr., manager of Shell's Chemical Sales Div., initial use of the material would probably be at toll booths and on dangerous grades and curves where traffic has worn road surfaces smooth and made them slick with oil.

Sheet for optical use

An ophthalmic cellulose acetate sheet, called Crystal Clad Black, has been developed by Rowland Products, Inc., Kensington, Conn., manufacturer of cellulose plastics for the optical industry. Layers of clear acetate are extruded

simultaneously on each side of a core of black so that the layers weld at the joint and become homogeneous.

Frames made of the new material have a high sheen which is said to improve with the handling they receive in use. In addition, the clear layers do not show nicks, according to the company.

Emphasis on distributors

Many of the exhibitors at the Eighth National Plastics Exposition, to be held November 17 to 21, 1958 at Chicago's International Amphitheatre, indicated that their displays will afford attractive opportunities for distributors.

Improving and expanding the marketing and distribution facilities in such fields as housewares, building materials, industrial products, specialty products, signs, etc., will be important objectives of the exposition and of the 1958 annual conference to be sponsored by The Society of the Plastics Industry, Inc.

At the annual conference, to be held at the Hotel Morrison, Chicago, Ill., the morning of Thursday, November 20, will be devoted to a discussion of merchandising and distribution.

Distributors serving or interested in serving the plastics industry may obtain tickets by writing to The Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y.

Plastic well casing

An improved high-impact styrene well casing for rotary, auger, and driven wells has been announced by Carlon Products Corp., an affiliate of American Research & Development Corp., Cleveland, Ohio. The new product is said to be stronger, yet costs one-third less than the company's previous well casing.

Named Carlon "T," the casing is easily installed without mechanical material handling equipment. It is pliable and will follow well holes even when they are out of plumb, the company states. Permanent joints are made quickly by a two-step solvent weld which is reported to be strong enough to be lowered in the well three minutes after ce-

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One of the most important applications of benzoyl peroxide is that it can serve as a catalyst for the polymerization of the numerous monomers initiated by free radicals. It is used for the polymerization of such monomers as vinyl acetate, vinyl chloride, vinylidene chloride, methylmethacrylate, styrene, ethylene, unsaturated polyesters, etc., and for copolymerizations of combinations of such monomers. It has found applications in polymerization in bulk, suspension, emulsion and solution systems. The amounts needed vary from 0.1% to 2% and the most effective temperature range is 90°-100°C. It also has found use in the preparation of styrenated alkyds and in the cross linking of silicone gums.

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ment is applied and sleeve-type joints pushed together and twisted. Pumping may begin immediately, Carlon asserts.

Although light in weight, the product will not lose shape after installation, it is claimed, and the wall thickness prevents "egging up" to block passage of pumping equipment. Unaffected by the corrosive action of any type of water or soil, the casing will not dent, split, or support mold growth. Use of the product is expected to be especially extensive in hard water areas.

Carlon "T" casing is available in 10- and 20-ft. lengths and in sizes up to 10 inches.

New research company

Lauren B. Hitchcock Assoc., 60 E. 42nd St., New York, N. Y., chemical engineers, has been formed for industrial research and development counseling, commercial chemical development, and technical and economic investigations.

Officers of the company are Dr. Lauren B. Hitchcock and General Edwin Cox. Dr. Hitchcock was formerly vice president of The Quaker Oats Chemicals Dept.; president of National Dairy Research Laboratories; and president of the Air Pollution Foundation. General Cox was previously vice president of Virginia-Carolina Chemical Corp.

Polypropylene yarn

Commercial production of polypropylene yarn, designated Reevon Series 800 Polypropylene (isotactic) Monofilament, has been announced by Reeves Brothers, Inc., 54 Worth St., New York, N. Y. According to John H. Karrh, managing director of the company's Plastics Div., the new yarn represents a completely new development in extruded plastics in the United States. It has many potential industrial uses, including the manufacture of rope, wet and dry filter elements, and in many fabrics where nylon, saran, and polyethylene fibers are used. The polypropylene yarn will be marketed in addition to three grades of polyethylene yarns manufactured by Reeves.

As typical of some other potential applications for polypropylene filaments, Mr. Karrh mentioned carpet fiber, upholstery yarn, filter material for air conditioners, and fabric for hats and caps. A woven polypropylene fabric, laminated with polyethylene fabric, would make a particularly light and strong material that could be used in the manufacture of luggage, small boat hulls, counter tops, and wall coverings, it was stated. In Germany, polypropylene yarns have been used for sheer ladies' hosiery.

The new Reevon yarn can be supplied either in natural clear or pigmented in a wide range of colors, stabilized against ultraviolet degradation.

Experimental plastics kit

A non-shrinking, modified polyester, a high-temperature epoxide, and a room temperature curing isocyanate foam for encapsulating and potting are offered in a new experimental kit by Electronic Plastics Corp., 675 Barbey St., Brooklyn, N. Y. Sufficient quantities of each compound are given to allow the experimenter to try various combinations and evaluate the results.

Designated Kit 3P, it is available from the manufacturer at $15, F.O.B., Brooklyn.

New way to sell plastics

The establishment of specialty stores for plastics has proved so successful in Western Germany that one of them, the "House of Plastics" in Hamburg, has recently been enlarged and now ranks among the largest specialty stores in that country.

The Hamburg store stocks a wide range of plastics materials, including about 650 different designs of decorating materials; 200 different patterns of plastics upholstery material; and about 950 different plastics household and other finished products.

Paint stripper

Baked organic finishes can be stripped from phenolic resins without injuring the phenolic base with Patclin #209, a new industrial stripper developed by Patclin Chemical Co., Inc., 11-23 St. Casimir Ave., Yonkers, N. Y.

Small pieces can be stripped in a tumbling barrel. They are then water rinsed, neutralized in a mild alkali, water rinsed again, and dried, and are then ready for refinishing.

Bromine in plastics

Flameproofing and a variety of other uses for brominated compounds for the plastics industry are highlighted in a special bulletin prepared by Michigan Chemical Corp., Saint Louis, Mich., manufacturer of the five bromine compounds discussed below.

Tetrabromobisphenol-A, having a bromine content of 58.8%, may be used for imparting flameproofness in applications where bisphenol-A is used, the company reports. These include epoxy, polyester, and polycarbonate resin components. It is also suggested as an antioxidant in vinyls and polyesters. Another possible use, according to Michigan, is as a flameproofing additive in polystyrene, phenolic, polyamide, polyurethane, cellulosic, polyethylene, and acrylic resins and in foams.

Low-molecular-weight epoxy resins can be prepared by reacting tetrabromobisphenol-A with epichlorohydrin, according to the firm.

Tris (2-bromoethyl) phosphate, with a bromine content of 57.2%, is said to be useful as a plasticizer and flameproofer in formulating polyester, vinyl, acrylic, cellulosic, urea formaldehyde, and polyurethane resins.

Pentabromophenol, which has a bromine content of 81.7%, is suggested as a flameproofing agent for phenolic resins, although the company points out that the compatibility of brominated flameproofing agents with phe-

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nolic resins has not been fully explored. The similarity of tetrabromobisphenol-A and pentabromophenol with the phenolic constituents of the phenol aldehyde-type resin leads to the assumption that these two compounds would be ideally suited for this application, Michigan asserts.

The compound can also give flame and mildew resistance when used as an additive in epoxy, polyester, polystyrene, vinyl, polyamide, polyurethane, and cellulosic resins and foams.

Tetrabromophthalic anhydride has a bromine content of 68.9 percent. It undergoes many of the reactions of phthalic anhydride and is said to be a valuable intermediate in the preparation of flame-retardant resins, plastics, waxes, and plasticizers for vinyl-type resins.

This compound may find application as a curing agent for epoxy resins with subsequent enhancement of the resin's flame-retardant properties, it is claimed. Polyesters can be rendered flame-retardant by directly incorporating the compound into the polyester molecules.

Tetrabromophthalic anhydride is reported to be compatible with polystyrene but has not exhibited good thermal stability during milling operations.

Tris (2, 3-dibromopropyl) phosphate, having a bromine content of 68.7%, may be used as a flameproofing additive in formulating polyesters, epoxies, vinyl, polyamides, polyurethanes, phenolics, and polysilanes, according to Michigan.

The company reports that Isolon nylon foam has been rendered flame retardant by treatment with this compound, which is applied either as a water emulsion or dissolved in an organic solvent. This compound is also said to be fully compatible with styrene and polystyrene molding powders. The company suggests a 2 to 3% addition of this flame retardant to polystyrene molding powders prior to fabrication as a starting point for the construction of flame-retardant polystyrene foams.

Michigan Chemical points out that attempts to render polystyrene foam flame retardant by treating the surface of the expanded foam with the company's chemicals have been unsuccessful and should not be recommended.

Polypropylene filaments

Rope is now being manufactured by Plymouth Cordage Co., Plymouth, Mass., from polypropylene, the newest thermoplastic resin now commercially available in filament form.

According to the company, polypropylene rope is significantly stronger, longer wearing, more heat resistant, and less slippery than polyethylene rope. It retains the desirable chemical resistance, rot resistance, floating quality, and low stretch of the polyethylene rope announced by Plymouth in 1956.

One of the outstanding qualities of polypropylene rope is said to be its high strength per unit weight, which is fully retained even under wet conditions.

Epoxies

Production started. Reichhold Chemicals, Inc. began production of epoxy resins at its plant in Ballardvale, Mass., several months ago. The company expects the plant to produce 10 million lb. of both liquid and solid epoxy resins annually, which will be marketed under the tradename Epotuf.

Floor coating compound. Epoxylite #3454, a new concrete floor coating and patching compound claimed to adhere tenaciously to both old and new concrete or asphalt, has been announced by The Epoxylite Corp., 10829 E. Central Ave., El Monte, Calif. According to the firm, the material hardens overnight at room temperature and provides complete resistance to moisture, acids, alkalies, oils and greases, detergents, petroleum solvents, alcohols, and jet fuels.

No special surface priming is required with the compound. The concrete coating spreads easily and may be applied in any thickness desired. For maximum chemical protection ¼ in. is said to be all that is necessary. After application, the material may be feathered and troweled smooth. Moderate internal resiliency allows for thermal expansion and contraction.

Epoxylite #3454 can be used on cinder driveways, block walls, walks, drainage ditches, and ramps, and as brick mortar. The product is claimed to permit concrete coating for a material cost of 10¢/sq. ft. It is available in a wide range of color pigments.

New modifier. Mod-Epox, a new modifier for liquid epoxy resin systems claimed to offer improved end properties and substantial savings in formulating costs has been announced by Monsanto Chemical Co.'s Organic Chemicals Div., St. Louis, Mo. The material is reported to impart a low initial viscosity, accelerate the rate of cure, and maintain or improve the physical and electrical properties of the finished resins while cutting their cost by 20% and more.

The price of this organophosphorous modifier is 46¢/lb. in carload drum lots compared with 80¢ to $1.25/lb. for glycidyl ethers which are currently used as diluents for epoxies. In addition to its price advantage over other modifiers, Mod-Epox is said to impart better dimensional stability and chemical and water resistance than is obtainable with unmodified resins or systems using other modifiers. Hardness of cured resins containing Mod-Epox is claimed to be equivalent to that of unmodified resins.

Curing agent. 4,4'-diaminodiphenyl sulfone (D.D.S.) has been used for decades in leprosy treatment. It has now been found to be an excellent curing agent for epoxy resins, according to Roussel Corp., 155 E. 44th St., New York 17, N. Y., American member

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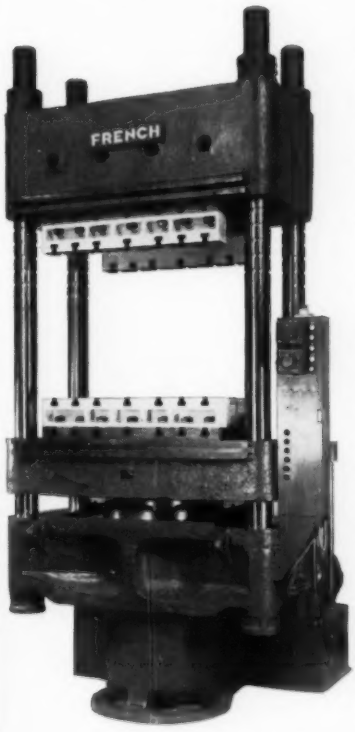

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To keep pace with the growing demand for plastics, and at the same time hold down rising costs, progressive manufacturers are seeking more automatic means of production. To aid them, General Electric offers a new packaged, adjustable-speed drive —the Speed Variator.

With this drive the speed of the extruder, calender, and auxiliaries may be coordinated and held accurately. As a result, you obtain a steady flow of production, with less danger of breaking or stretching and with a minimum of operator supervision. The wide choice of speeds permits you to process a greater variety of plastics with your present equipment.

For more information on the new Speed Variator, write for Bulletin GEA-6643. *Direct Current Motor and Generator Department, Erie, Pennsylvania.*

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of the French Roussel group, a leading D.D.S. supplier in Europe.

Castings and laminates cured with D.D.S. are said to exhibit excellent high temperature strength. High heat distortion points (about 180° C.) and desirable electrical properties are cited as other features. Marketed by Roussel under the tradename Eporal, D.D.S. is said to show promise in many applications in the electronics and aircraft industries, and in the manufacture of missile components and certain consumer goods.

According to the company, D.D.S. is practically non-toxic and reduces problems in handling caused by the toxicity and volatility of certain curing agents.

Coating resins. Three solid epoxy resins—D.E.R. 661, 664, and 667—have been developed by The Dow Chemical Co., Midland, Mich. The resins will be used in coatings for appliances, cans, drums, and tank cars, for auto body primers, and for industrial maintenance.

The resins are said to possess superior purity, enabling processors to use the dissolved resin without filtering. It is claimed that the resins have extreme clarity.

D.E.R. 661 is a low-molecular weight resin for catalytically cured coatings, and can be cured at room temperatures. D.E.R. 664 is reported to be useful in ester type one-component systems needing no curing agent, while D.E.R. 667 is catalytically cured, requiring high baking temperatures, and gives good flexibility and toughness.

Cuts material costs. An epoxy extender, NX 3157, claimed to make a chemical bond with the resin at low temperatures and to cut material costs by 25% without impairing properties when mixed with the resin at the recommended rate of 50:50, has been announced by Irvington Chemical Div., Minnesota Mining & Mfg. Co., 500 Doremus, Newark, N. J.

According to the company, a further saving results from a decrease in resin viscosity effected by the extender, which makes possible the addition of more filler. Price of the extender is expected to be about half the price of most liquid epoxy resins.

Its most immediate application is expected in coatings where the chemical and adhesive qualities of epoxies are indicated, but where cost has barred their use.

Adhesives

For plywood. A wood chemical extracted from the bark of western hemlock, claimed to yield a low-cost, weatherproof, thermosetting adhesive for plywood, has been announced by the Olympic Research Div. of Rayonier, Inc., Shelton, Wash.

Designated HT-120, the chemical has proved to be a successful intermediate agent and the resulting adhesive meets all commercial requirements for exterior type plywood. It substantially reduces the amount of phenol normally required in such adhesives.

The new adhesive based on HT-120 can be produced in a dry form or as a 40 to 45% solids solution claimed to be quite stable at ordinary temperatures. The formulation calls for 49% bark extract, 34% polymethylolphenol, and 17% filler on a solids basis.

Contact cements. Two new series of contact cements, especially formulated for manual operation or for application with standard production equipment, have been added to the line of structural adhesives offered by National Starch Products, Inc., 750 Third Ave., New York, N. Y. Marketed as Instant-Lok 4010 and Instant-Lok 4020, they are formulated of oil-resistant elastomers modified with synthetic resins and dissolved in a blend of organic solvents.

Instant-Lok 4010 is said to be a high-speed, high-production, high-strength glue with outstanding heat resistance. Designed for use with automatic glue spreaders or spray guns, and where fabricated parts are dried and activated in ovens, this cement is claimed to bond instantaneously.

In plants where manual operation is used, the manufacturer recommends the 4020 series. A

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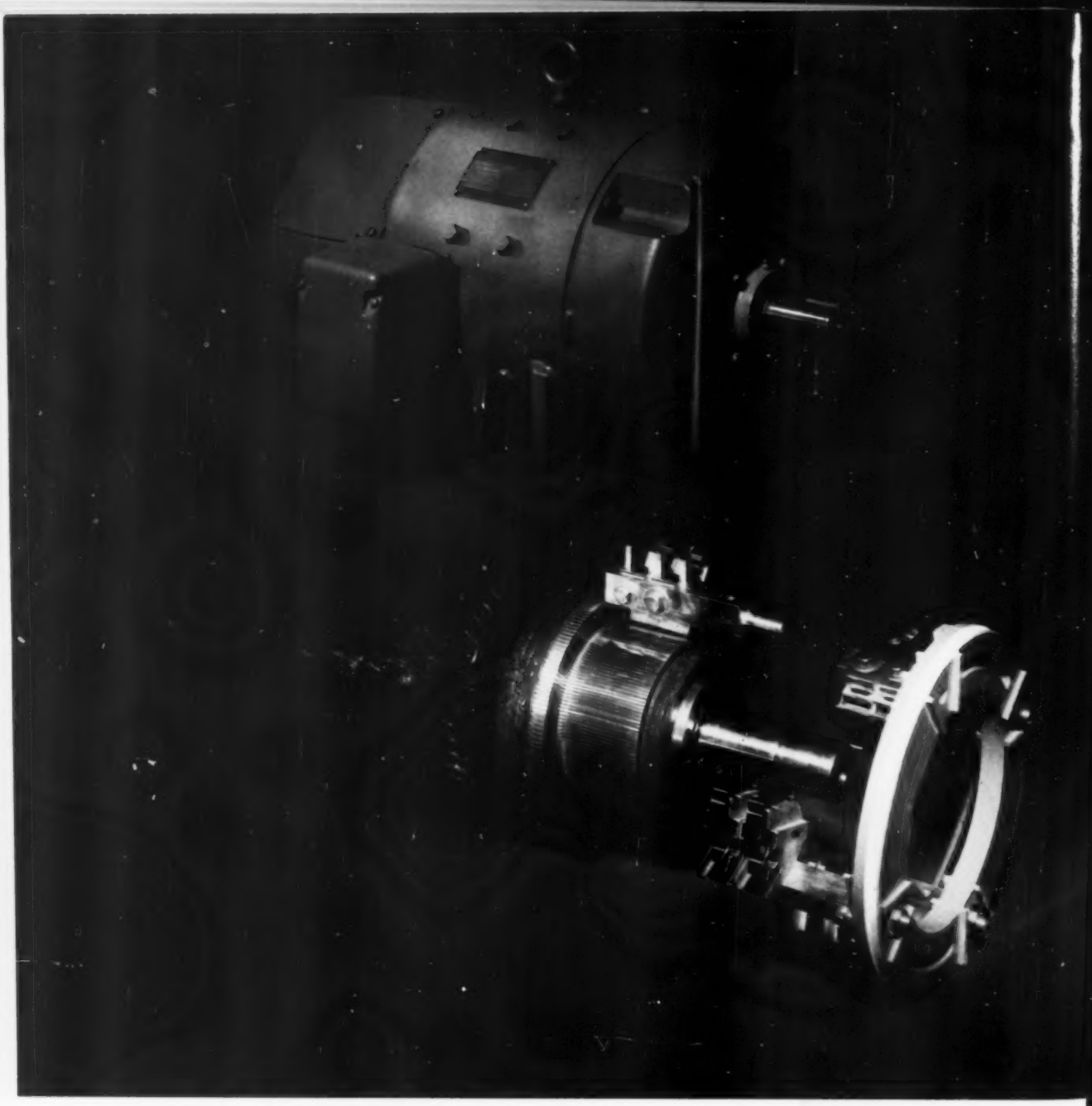

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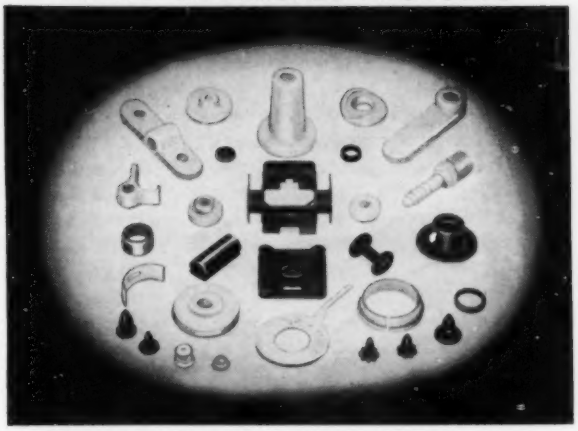

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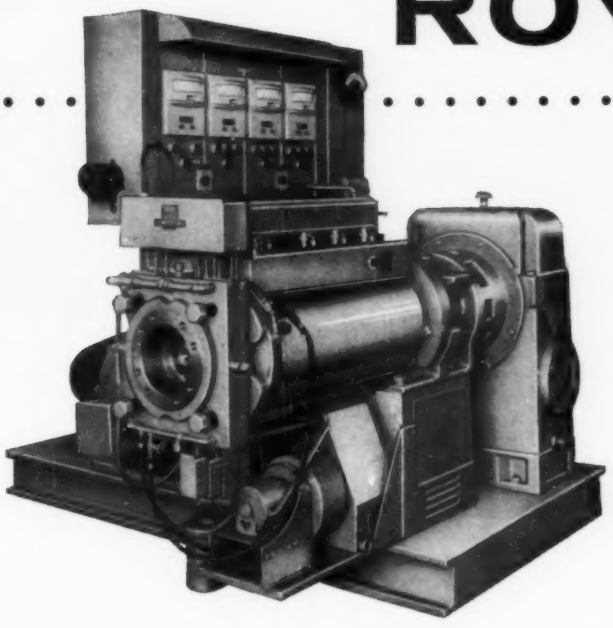

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The Plastiscope

general-purpose contact cement with a maximum open assembly time of one hour, Instant-Lok 4020 is reported to be especially suited for application of high-pressure laminates to plywood particle board and other core materials.

For heat cured finishes. A specially formulated resin glue claimed to have high initial tack and capable of withstanding greater heats than any polyvinyl assembly glue has also been introduced by National Starch Products, Inc. Designated Wood-Lok 16, it is a fast-setting, ready-for-use, liquid resin glue adhesive designed for joint assembly where heat cured finishes are used. According to the company, this copolymer emulsion glue resists forced baking in drying ovens and maintains a secure bond during shipment in railroad box cars, where high temperatures are common during the summer. Wood-Lok 16 is reported to exhibit a high resistance to lacquer solvents and paints. The adhesive has a storage and working life of several months.

Bonds foam. A quick-drying, fast-grabbing, foam splicing adhesive, Bondmaster R275, which incorporates a synthetic polymer that is said to contribute unusual spread characteristics to the product, has been announced by Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N. J.

According to the company, very thin glue lines of R275 can be applied without detrimental effect on bond strength, thus obtaining a greater yield per gallon and faster grab. The thin glue line also avoids "dimpling," a serious problem in foam cushion manufacture, and produces a softer seam. Application can be by brush, spray gun, or roller.

Bondmaster R275 is claimed to bond almost all types of urethane foams, natural latex rubber foams, and sponge to themselves and to each other with bonds that are stronger than the foams or the sponge being mated.

The new adhesive has a synthetic elastomer base, is shipped at a viscosity of from 600 to 1000 cp., and consists of approximately 14 to 16% solids by weight. The color is a clear, pale yellowish tint.

Expansion

Norgren-Stemac (formerly Stemac, Inc.), Div. of C. A. Norgren Co., has completed its new 54,000-sq. ft. factory at 5400 S. Delaware St., Littleton, Colo. The new facility will house the design, manufacturing, die casting, plating, and plastics divisions of the company.

The firm manufactures name plates, and a new integrated department features plastics injection molding equipment with capacities up to 12 oz., with special emphasis on items of 2 oz. or under.

Pressure Blast Mfg. Co., Inc., Manchester, Conn., has acquired

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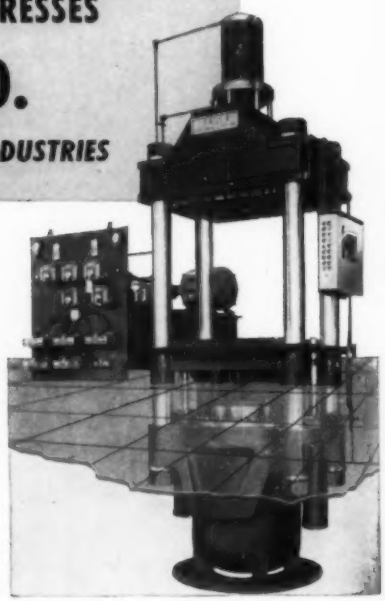

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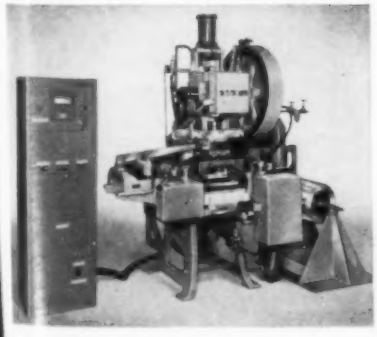

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The Plastiscope

all the assets and manufacturing rights of **Cro-Plate Co.**, Hartford, Conn. The line of wet blasting equipment and abrasives will be continued.

Manufacturing and sales offices have been relocated at Manchester.

Wyandotte Chemicals Corp., Wyandotte, Mich., announces completion of its expanded research facilities which include laboratories, test cells, and supporting facilities to permit a wide range of corporate and Defense Dept. research projects dealing with high pressures and temperatures, and with toxic materials. **Dr. J. W. Zabor**, director of research, states that this expansion will permit increased effort in the research and development of new polymers, elastomers, fuels, and lubricants.

The company also announces that production has started at its new chemical manufacturing center at Geismar, La., which includes an ethylene oxide-glycol plant with an annual capacity of 60 million lb. of ethylene oxide. The facility is said to be producing at anticipated capacity and its output has been sold for the balance of 1958 and well into 1959.

The Harshaw Chemical Co., Cleveland, Ohio, and **Kentucky Color & Chemical Co.**, Louisville, Ky., announce that negotiations are underway for the merger of the two companies, with Kentucky to operate as a separate subsidiary corporation.

Emphasis will be placed on improvements and additions to the Louisville plant, and extension of research and product development activities.

No change in Kentucky's sales organization is contemplated.

Jayron Corp., Leominster, Mass., custom vacuum metallizer, is undergoing its second plant expansion within two years. The expansion provides the company with a total of 25,000 sq. ft. of manufacturing space for metallizing plastics, metal, and glass.

Leathertone, Inc. announces the addition of 8000 sq. ft. of space to its manufacturing facilities at 6-14 Medford St., Boston, Mass., and the installation of an additional 10 opening 30- by 60-in. high-pressure laminating press.

The company has also moved its general offices from 260 Tremont St. to 12 Medford St.

In addition to continuing the manufacture of decorated thermoplastic and thermosetting sheets, Leathertone now laminates vinyl, Mylar, Videne, etc. to aluminum, steel, plywood, and Masonite.

National Tool Co., Cleveland, Ohio, has acquired **Auto-Vac Co.**, Bridgeport, Conn., manufacturer of machinery for vacuum forming, pressure forming, and deep-draw plug forming of thermoplastic sheet materials and plastics packaging.

Auto-Vac will continue to operate in Bridgeport as an independ-

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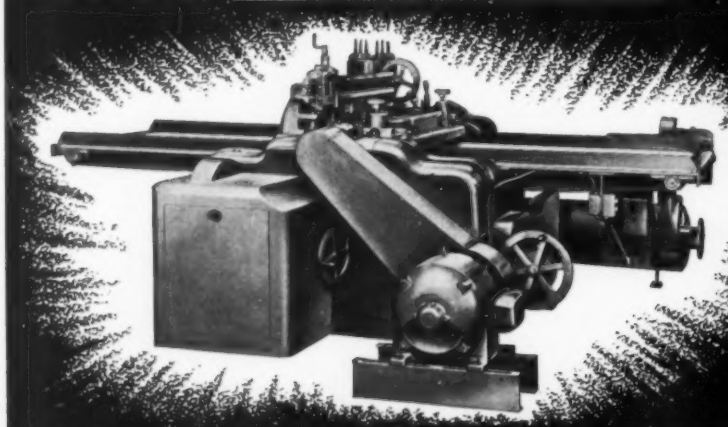

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ent division of National Tool under the direction of **E. Bowman Stratton, Jr.**, former owner of Auto-Vac, who was elected vice president of the new parent organization.

Robert L. Butzko, former partner, will continue with the company as a consultant.

The Whitehead & Hoag Co., Newark, N. J., manufacturer of plastics calculators, badges, advertising specialties, etc., has acquired the manufacturing and sales facilities of **Creative Plastics Corp.,** Stony Brook, N. Y., producer of clear Lucite embedments marketed under the tradename of Plastallions.

Todd Harris, president of Creative, will head the new Plastallion Div. of Whitehead & Hoag. Key production personnel and all fabrication equipment from Creative will be installed in the Newark plant of the new parent company.

United States Chemical Milling Corp., Manhattan Beach, Calif., has purchased all of the outstanding stock of **Paul Omohundro Co.,** Paramount, Calif., manufacturer of fibrous glass laminated structures for military and commercial applications.

The acquired company will operate as a wholly-owned subsidiary, with **Paul Omohundro,** founder, continuing as president.

B. F. Goodrich Industrial Products Co. has completed a $700,000 expansion program, including construction of a new warehouse and additions to production facilities at its plastics products plant at Marietta, Ohio.

The new warehouse adds 72,000 sq. ft. of floor space to the Marietta plant which produces Koroseal vinyl products.

Meetings

Plastics groups

October 1: Society of Plastics Engineers, Inc., Regional Conference, Hotel Statler, Hartford, Conn. Subject: "Plastics in Packaging."

October 9-10: The Society of the Plastics Industry, Inc., 14th New

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Automatic Cycle Speed—50 to 500 p/h
Automatic Cylinder Heat Control: ± 1°
Automatic Mold Heat Control: ± 1°
Automatic Hopper—For Accurate Feeding
Automatic Nozzle Shut-Off Valve
Automatic Ejection of Molded Items

1/3-Ounce Capacity Completely Automatic

Semi-skilled operator can set up and operate press in 30 minutes . . . press operates on 100 psi line pressure . . . bench space required—18" x 30" . . . press height—26".

⅓ Ounce Capacity Completely Automatic

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Mfg. Co.

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Chicago 51, Ill., U.S.A.

England Section Conference, Wentworth-by-the-Sea, Portsmouth, N. H.

October 21: Society of Plastics Engineers, Inc., Regional Technical Conference, Curtis Hotel, Minneapolis, Minn. Subject: "Epoxies."

November 13: Society of Plastics Engineers, Inc., Regional Technical Conference, Ambassador Hotel, Los Angeles, Calif. Subject: "Plastics in Building and Construction."

November 17-21: The Society of the Plastics Industry, Inc., 8th National Plastics Exposition, International Amphitheatre, Chicago, Ill.

November 17-21: The Society of the Plastics Industry, Inc., S.P.I. Annual National Conference, Morrison Hotel, Chicago, Ill.

Other meetings

October 8-10: Industrial Designers Institute, Design Materials Show and Annual Conference, Sheraton-East (formerly the Hotel Ambassador), New York, New York.

October 20-22: Technical Association of the Pulp and Paper Industry, 13th TAPPI Plastics-Paper Conference, Sheraton-Kimball Hotel, Springfield, Massachusetts.

October 20-24: American Vacuum Society, Inc., 5th National Vacuum Symposium, Sir Francis Drake Hotel, San Francisco, California.

October 28: Association of Consulting Chemists and Chemical Engineers, Inc., 30th Annual Meeting, Biltmore Hotel, New York, N. Y.

November 4-6: Packaging Association of Canada, Canadian National Packaging Exposition, Automotive Building, Exhibition Grounds, Toronto, Ontario, Canada.

November 5-6: Society of Vacuum Coaters, Annual Meeting, Hotel Statler, Detroit, Mich.

November 12-13: Chemical Market Research Association, Meeting, St. Paul Hotel, St. Paul, Minn. Subject: "Adhesives."

Companies . . . People

Celanese Corp. of America, Plastics Div.: New Marketing Dept. established with **Edward W. Ward,** formerly sales mgr., appointed to the new division post of dir. of marketing. **Dr. W. Paul Moeller** succeeds Mr. Ward as sales mgr.; **James W. Flynn** replaces Dr. Moeller as market development mgr.

The new department consolidates various functions, including sales development, with **Edward H. Miller** as mgr.; advertising and sales promotion, with **Harriet Raymond** as mgr.; and the facilities of the Plastics Product Application and Technical Service Laboratories at Newark, N. J. A total of 200 persons now become members of the Marketing Dept.

E. W. Ward W. P. Moeller J. W. Flynn

United States Rubber Co.: Dr. Thomas L. Wilson named mgr. of the Research Center in Wayne, N. J., where basic and applied research in plastics, rubber, chemicals, and textiles are conducted for all the operating divisions of the company. He replaces **Dr. Arthur E. Brooks,** who was recently appointed as asst. dir. of the Research and Development Dept.

Naugatuck Chemical Div.: Dr. Wesley S. Coe named dir. of research and development to succeed **Dr. D. Lorin Schoene,** who was appointed an asst. dir of research and development for the company. **F. Dudley Chittenden,** appointed to the new post of mgr. of Marvinol operations, will direct sales, production, and development of Marvinol vinyl resins. **D. L. McCollum** replaces Mr. Chittenden as division prod. mgr. and **J. Nelson Judy** succeeds Mr. McCollum as sales-production-coordination mgr.

Archer-Daniels-Midland Co.: Charles R. Buerki named Cleveland tech. sales rep. for the Chemical Products Div., with offices at 2191 W. 110th St., Cleveland, Ohio. **Vernon C. Rollins,** tech. sales rep., transferred from San Francisco to Los Angeles, Calif.

Du Pont, Polychemicals Dept.: John F. Lontz promoted from research supv. to sr. research chemist. **Bennett N. Epstein,** a physical chemist, and **Edgar N. Brightbill,** a chemical engineer, promoted to research supvs. Mr. Epstein will work on the product development of Teflon. Mr. Brightbill will continue his studies on economic evaluations for research guidance.

Allied Chemical Corp.: Cortez P. Hackett, previously VP of the **Solvay Process Div.,** appointed dir. of research and development of the corporation. He will report to **Dr. Glenn A. Nesty,** VP in charge of research and new product development, and will make his headquarters in New York.

National Aniline Div.: William B. Yarborough, formerly chief engineer of the **General Chemical Div.,** appointed asst. to the pres. of National Aniline.

Union Carbide Corp.—Bakelite Co.: John K. Honish, with the company 25 years, appointed market analyst on the staff of the Market Research Dept. He will be concerned primarily with the development of vinyl resins and compounds, and his duties will include the economic, market, and technical aspects of this field.

Visking Co.: Mayhew M. Clark has joined the Plastics Div. as a tech. sales rep. and will concentrate on the marketing of black Visqueen polyethylene film for farm applications.

Monsanto Chemical Co.: Roy L. Brandenburger, VP, named sr. rep. on the West Coast, with offices in Santa Clara, Calif.

Plastics Div.: Winston H. Richter, formerly Chicago dist. sales mgr., now New England dist. sales mgr. at Springfield, Mass. **Gerard J. Marceau** now Chicago dist. sales mgr.; **Wilbur M. Swan,** previously a sales rep., named asst. dist. sales mgr. at Chicago, Ill.

American Cyanamid Co.—Cyanamid International: Raymond E. Lapean, Richard C. Scott, Henry W. Rojas, and **John F. Gates** appointed to newly created posts of regional dirs. This unit was formed January 1958 to coordinate all of the company's operations outside of the United States and Canada.

Mr. Lapean will cover Europe from headquarters in Zurich, Switzerland. Mr. Scott will be in charge of the Far East, with offices in Tokyo. Mr. Rojas will headquarter at the main New York office and will cover Latin America. Mr. Gates will cover all of Africa south of the Sahara, with headquarters at New York.

Pigments Div.: George H. Carleu named sales rep. for the metropolitan Chicago, Ill., area.

Formica Corp.: C. R. Bailey appointed dist. mgr. of the newly formed Columbus, Ohio, district sales office.

Heyden Newport Chemical Corp.: International Div.: Clement H. Horst, with the company 23 years and formerly asst. VP, appointed VP and gen. mgr. He succeeds **Ernest E. Holdman,** retired.

American Plastics Corp: Elmer Smith, with the firm 15 years, named sales mgr.

James S. Detwiler, previously asst. gen. mgr. of **Yardley Plastics Co.,** now mgr. of **Yardley Molded Plastics, Inc.,** Columbus, Ohio. He will be in charge of sales, engineering, and production.

The Goodyear Tire & Rubber Co., Chemical Div.: Robert E. Workman, formerly mgr. of **Goodyear International Corp.,** a subsidiary of Goodyear Tire, appointed to the newly created post of asst. gen. mgr. of the parent company's Chemical Div. **H. D. Allick** named mgr. of the Plastics Dept. to succeed **A. E. Polson,**

R. E. Workman H. D. Allick

resigned. Mr. Allick will be responsible for sales of Goodyear's Pliovic resins. He has been in the sales dept. since 1952.

To coordinate more effectively direct field activities, the division has created three new dist. mgr. positions: **A. R. Merritt,** Hartford, Conn.; **L. P. Thies,** Detroit, Mich.; and **L. E. Stanton,** Houston, Texas.

H. Kohnstamm & Co., Inc., supplier of industrial pigments, will move its executive offices from 83 Park Pl. to 161 Avenue of the Americas, New York, N. Y., and will relocate its warehouse facilities from the Park Pl. address to new sites in the metropolitan New York area.

Sommers Plastic Products Co. has opened a new sales office at 330 Fifth Ave., New York, N. Y.

Wallace & Tiernan, Inc., Belleville, N. J.: **Dr. F. Visser't Hooft,** a member of the board of directors, elected to the board's Executive Committee and pres. of the Lucidol Div.

Lucidol Div., Buffalo, N. Y.: **A. I. Andrews,** previously asst. gen. mgr.,

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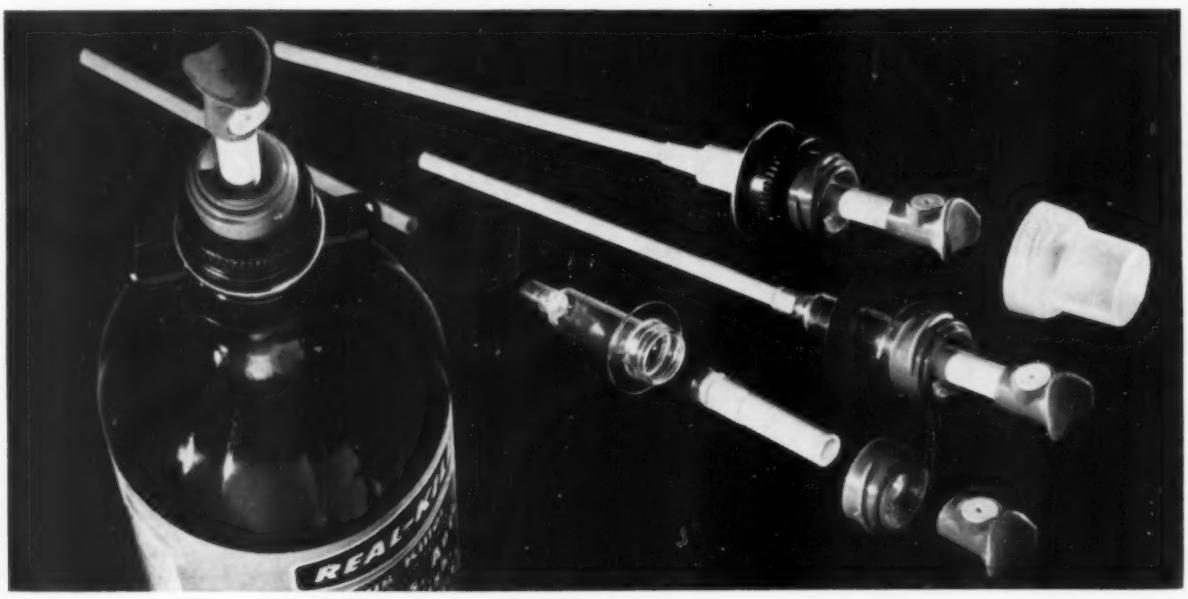

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Companies . . . People

appointed gen. mgr. He succeeds **C. H. Rybolt,** who was appointed dir. of the firm's Chemical Divs. at Newark, N. J. **F. J. G. de Leeuw** named special asst. to the pres.; **G. F. Linden,** gen. plant mgr.; **Dr. J. B. Harrison,** mgr. of research and development; **Dr. O. L. Mageli,** chief chemist.

Fiberfil, Inc., Warsaw, Ind.: **Thomas P. Murphy,** formerly with Spencer Chemical Co., appointed eastern dist. mgr. **K. E. Munro,** previously sales engineer of Richardson Co., named Chicago dist. mgr. Fiberfil manufactures glass-reinforced injection molding compounds.

Reeves Bros., Inc. has moved its New York offices from 54 Worth St. to 1071 Avenue of the Americas, New York, N. Y. The company manufactures polyethylene and polypropylene filaments for textiles, tapes, synthetic rubber-coated fabrics, etc.

Standard Packaging Corp.: Wilson J. Main appointed dir. of market research. **Joseph A. d'Avi** named asst. to the gen. sales mgr.

Society of Plastics Engineers, Inc. has moved its national offices from 34 E. Putnam Ave., Greenwich, Conn., to 65 Prospect St., Stamford, Conn.

E. H. Swazey, VP and chief engineer of **Lone Star Plastics Co., Inc.,** elected pres. of S.P.E.'s newly formed North Texas Section. Offices are at Commercial Services, 461 Calhoun, Fort Worth 4, Texas.

George H. Reed named chrmn. of the Plastic Pipe Research Council of **The Society of the Plastics Industry, Inc.**

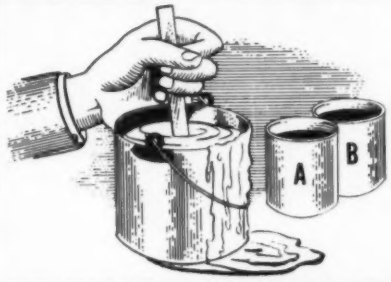
Louis F. Hewett named chief engineering consultant to **Permagile Corp. of America,** Woodside, N. Y., manufacturer of plastic-alloy materials for heavy masonry construction and industrial maintenance.

James J. Babson appointed tech. sales engineer of **Midland Plastics,** 4 Richmond St. E., Toronto, Ont.

Donald W. Smith named regional sales mgr. for **Devcon Corp.,** Danvers, Mass. He will be responsible for the sale of Plastic Steel and other Devcon products in the midwestern and southwestern states.

Edward J. R. Hudec named to the newly created post of dir. of manufacturing for **Vichek Tool Co.,** Cleveland, Ohio. He will direct manufacturing operations at the

HAND MIXING 2-PART RESINS?



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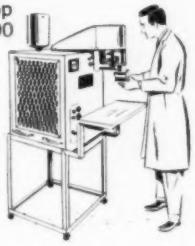
Try this simple test: divide a batch of hand-mixed material and set the two parts aside to cure. When you observe that one part cures faster than the other because of a difference in uniformity, remember that all the other characteristics you want in a resin will be non-uniform, too!

That's why many TRIPLEMATIC* Pumps now in use are servicing operations requiring less than a gallon of material a day . . . because uniformity is essential with 2-part resins, regardless of your volume . . . TRIPLEMATIC Pumps can assure the perfect, uniform mixture every time!

And, if you are producing at a high volume, remember: only the Hardman TRIPLEMATIC Pump can dispense uniformly mixed material continuously, at top speeds—up to 36,000 units per shift!



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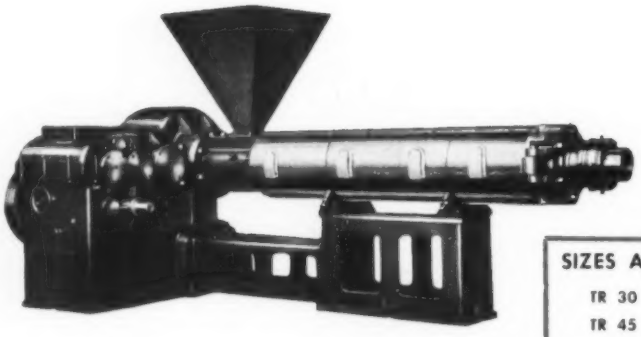

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Companies... People

Cleveland Hand Tool Div. and the Middlefield, Ohio, **Plastics Div.** which is engaged in custom molding and the manufacture of plastic boxes and floral vases.

W. D. Meadows appointed West Coast tech. services rep. for **Colton Chemical Co., Div. of Air Reduction Co., Inc.** He will assist **Travis V. Rankin,** dist. mgr. of the West Coast headquarters at 3409 Medford St., Los Angeles, Calif.

Dr. A. James Skey named marketing rep. for **Amoco Chemicals Corp.,** Chicago, Ill., and will be permanently located in London, England. He will handle the company's raw materials for the plastics, chemical, paint, rubber, and petroleum industries in the overseas market.

Harry F. Davis & Sons, 3262 Warrington Rd., Shaker Heights, Ohio, sales reps. in northern Ohio and western Pennsylvania for **Gries Reproducer Corp.,** New Rochelle, N. Y., will also represent Gries in the northwest counties of W. Va.

W. B. Wallace, plant supt. of the Arlington, Vt., plant of **Mack Molding Co.,** has retired after 18 years' service with the company.

Charles J. Wiley appointed market development mgr. of **Callery Chemical Co.,** Pittsburgh, Pa.

Henry Jones & Associates, 1500 N. Woodward, Royal Oak, Mich., named sales rep. by **Zenith Plastics of Michigan, Inc.,** 9 S. Adams St., Ypsilanti, Mich. Zenith is engaged in custom fabricating, vacuum forming, and injection molding.

Jay D. Sherman, previously dist. mgr. of the New York branch office, promoted to field sales mgr. of **Reed-Prentice Div., Package Machinery Co.,** East Longmeadow, Mass. He will supervise the sales force handling Reed-Prentice plastic injection molding and die casting machines in the firm's eight branch offices throughout the country.

General Trimming Products, Inc., San Gabriel, Calif., appointed by **Arvin Industries, Inc.,** Columbus, Ohio, to handle sales of Arvinyl vinyl-metal laminates in California.

Herbert J. G. Frost named asst. gen. mgr. of the Chemical Group of **Sun Chemical Corp.,** 750 Third Ave., New York, N. Y.

James P. Kelleher named sales mgr. of **Alpha Plastics, Inc.,** Livingston, N. J., producer of rigid polyvinyl chloride pipe and tubing. He comes

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- 30-50 gram capacity
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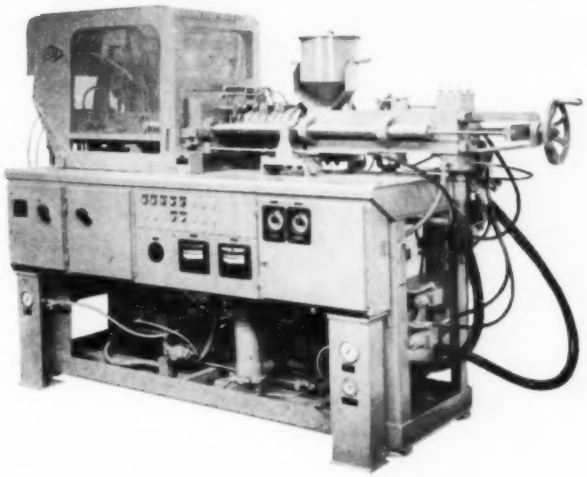
- 9¼" stroke
- fully automatic

*dependent on material and mold construction



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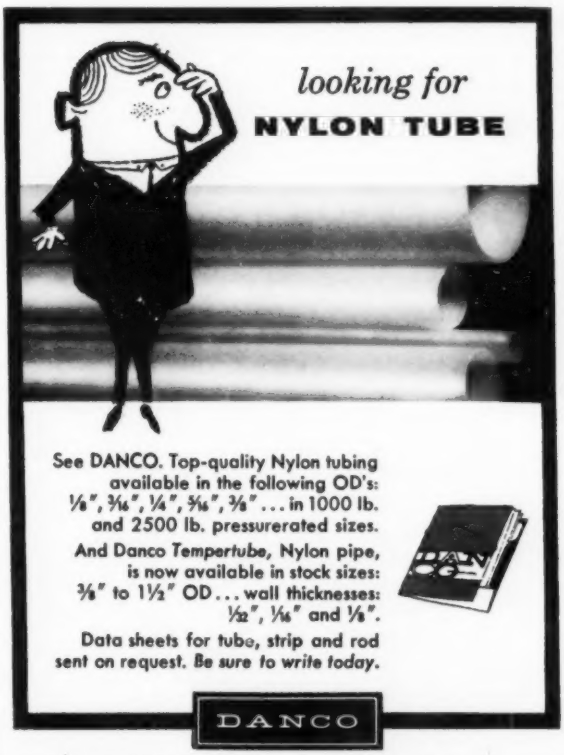
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Companies... People

to the company from the Alloy Tube Div. of Carpenter Steel Co., where he served as asst. mgr. of product engineering and development.

E. B. Brooks elected a VP of **Columbian Carbon Co.**, 380 Madison Ave., New York 17, N. Y. He will be in charge of the company's Carbon Black and Pigment Div., a post formerly held by VP **A. Harvitt**, who has retired. Mr. Brooks came to the company in 1955 as gen. sales mgr. and is currently a dir. and pres. of **Columbian Carbon International, Inc.**

Reichhold Chemicals, Inc. has established a new South Florida sales territory to service manufacturers using inorganic chemical colors and synthetic resins. **Ralph L. Johnson,** with the company 27 years and formerly in the Jacksonville, Fla., office, will manage the new territory from offices at 4471 N.W. 36th St., Miami Springs, Fla.

American Can Co.—Bradley Container Corp.: Kenneth M. Leghorn, pres. of **Sun Tube Corp.** since 1953, named pres. of Bradley to succeed **Leonard A. Britzke** who has returned to the parent company as gen. mgr. of manufacture, **Canco Div.**

Sun Tube Corp.: Joseph D. Martin, exec. VP, succeeds Mr. Leghorn as pres.

Atlas Powder Co.: Ralph K. Gottshall, pres., will also assume the office of chrmn. of the board to succeed **Isaac Fogg,** who has retired after 46 years' service with the company. **Edward J. Massaglia,** formerly gen. mgr. for operations of the Chemicals Div., elected VP and gen. mgr. of the newly consolidated chemical divisions.

L. Dobson, formerly polyethylene dir. of the Alkali Div., appointed engineering dir. of the Plastics Div. of **Imperial Chemical Industries, Ltd.**, London, England.

Houghton Laboratories, Inc., manufacturer of Hysol products and compounder of epoxy plastics, has created a separate division, **Hysol of California**, 1706 N. Potrero, El Monte, Calif. **Lloyd M. Dixon,** appointed VP and gen. mgr. of the division, will manage operations in the nine western states.

General Mills, Inc., Chemical Div.: New sales and service offices opened in Boston, Mass.; Philadelphia, Pa.; Houston, Texas; and Los Angeles and San Francisco, Calif. The division produces Versamid polyamide

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resins, Genamid epoxy co-reactants, fatty nitrogen derivatives, and sterols at Kankakee, Ill.

David E. Terry named tech. service and sales development mgr.; **M. S. Herban,** tech. service rep.; **R. B. Kron,** asst. to the mgr. of sales.

New England Laminates Co., Inc., Stamford, Conn.: **Technical Marketers, Inc.,** 550 Fifth Ave., New York, N. Y., and **Don V. Hamilton & Co., Inc.,** 3359 Republic Ave., Minneapolis, Minn., appointed to handle Nelco clad and unclad plastic laminates.

James R. Davidson named exec. VP in charge of operations of **Capac Industries, Inc.** and **Capac Plastics, Inc.,** Minneapolis, Minn., as part of the Capac's re-organization plan to allow the companies to concentrate exclusively on sheet extrusion and sheet forming, both custom and proprietary.

Nopco Chemical Co. and its subsidiary, **Metasap Chemical Co.,** have moved their general offices from Harrison, N. J., to 60 Park Pl., Newark, N. J., where the executive sales, accounting, and advertising departments will be housed.

Hayward Heubeck Co., 1101 N. Payson St., Baltimore 17, Md., appointed by **Landers-Segal Color Co.,** 78 Delavan St., Brooklyn 31, N. Y., to handle sales of its Lansco colors in contiguous territory.

H. Oscar Witten named export manager of **The General Tire & Rubber Co.'s Plastics Div.** He will headquarter at the **Bolta Div.,** Lawrence, Mass.

Chester L. Ward appointed VP and gen. mgr. of **Molded Fiber Glass Co.,** Ashtabula, Ohio. He formerly operated his own reinforced plastics consulting firm in San Francisco.

Harry H. Wenk, 140 N. Robertson Blvd., Beverly Hills, Calif., named West Coast sales rep. by **Merix Chemical Co.,** 1021 E. 55th St., Chicago 15, Ill., will handle the firm's line of anti-statics, mold-lubricant, ultra-violet absorbers, and wetting agents.

W. Mel Taylor has joined **F. J. Stokes Corp.,** Philadelphia, Pa., as assistant to the VP, sales, and mgr. of marketing.

Everett E. Klicker named market research mgr. of **Michigan Chemical Corp.,** Saint Louis, Mich. He will assist **H. Stanley Lawton,** VP of sales and development.

L. P. Raubenheimer of **Peter Partition Corp.** is the new pres. of the **National Paper Box Suppliers Assn.** He was elected at NPBSA's recent annual convention in Detroit, Mich.

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BECAUSE . . . Marvels are protected and of sound construction to give long life and efficient filtration.

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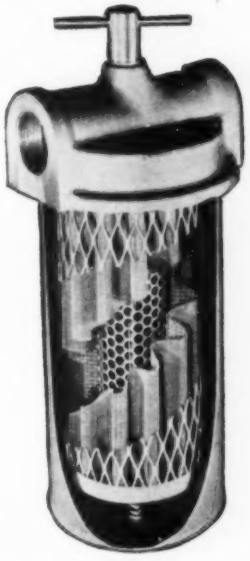

LINE TYPE (cutaway)

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Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated:

- ☐ Catalog No. 108—For Hydraulic Oils, Coolants, Lubricants
- ☐ Catalog No. 200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog No. 400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog No. 301—For Water

Name .....
Company .....
Address .....
City .....
State .....

MP-9

Classified Advertisements

EMPLOYMENT • BUSINESS OPPORTUNITIES • USED OR RESALE EQUIPMENT

Machinery and equipment for sale

FOR SALE: Five 1946 Reed Prentice molding machines. Two 22 oz. and three 8 oz. used daily for production. Maintenance of equipment excellent. Equipment overhauled each year with new replacement parts where necessary. We are a proprietary manufacturer and not a dealer. Many new replacement parts available with equipment. Call or write Mr. Edwards, LU 2-5252. Bernard Edward Co., 5252 S. Kolmar, Chicago 32, Ill.

FOR SALE: 1000 ton and 2000 ton hydraulic presses—1 oz. model H-200 Van Dorn injection machine—3 oz. Fellows, 8 and 12 oz. Lesters, 50 oz. Impco,—400 ton 36"x36" vertical presses—No. ½ and 1½ Ball and Jewell grinders—Carver laboratory presses and others to 75 ton—6"x13" laboratory mills—Plastic Machinery Exchange, 426 Essex Avenue, Boonton, N.J., phone DE 4-1615—Cable address Plasmex-Boonton.

FOR SALE: 5—750 gal. stainless reactors. 11—Baker-Perkins 200 gal. sigma-blade mixers. Pfaudler glasslined reactors: 750, 500, 300, 100, 30 gal. Farrel-Birmingham 1500 HP horiz. reducer, 5:1 ratio, ribbon mixers 336, 200, 75 cu. ft. Stokes tablet or preform presses, rotary cutters, mills, etc. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: Two gridler no. 10H 10KW HF generators 13.2 meg. 1 unit used 1500 hours. 1 unit used 500 hours. Less oscillator tubes. Reply Box 3905, Modern Plastics.

LIQUIDATION SALE: molding plant: (2)—325 ton French Oil compression presses. (1)—300 ton Erie compression press. (2)—170 ton transfer presses. (1)—100 ton compression press. (3)—75 ton transfer presses. (1)—No. 5½ T Colton preform machine. (1)—3 DT Colton tablet machine. Reply Box 3906, Modern Plastics.

FOR SALE: Stokes 300 ton and Baldwin-Southwark 200 ton semi-automatic transfer molding presses. 2500 ton downstroke 54" 102". French Oil 250 ton 38"x28". Elmes 200 28"x26". 200 ton hobbing press. 200 ton 16" record presses. D & B 140 ton 36"x36". French Oil 120 ton self-contained. W. S. 120 ton 24"x24". Hydraulic pumps and accumulators. Van Dorn 1 and 2 ounce injection machines. Other sizes to 100 oz. Baker-Perkins and Day jacketed mixers. Plastic cutters. Oxford 57" slitter. Seco 6"x13" and 8"x16" mills and calenders. Adamson 6" rubber extruder. Oil and Elect. Plastic extruders, lab to 6". Single & Rotary preform presses ½" to 4". Partial listing. We buy your surplus machinery. Stein Equipment Co., 107—8th St., Brooklyn 15, N.Y.

FOR SALE: 4 compression molding presses, 470, 200, 100 and 40 tons; 1 Ball & Jewell #1 rotary cutter, 15 HP motor; 1 Porter 33 cu ft stainless steel ribbon blender; 1 MPM 1½" electrically heated plastics extruder; 1—22" x 60" plastics mill; also choppers, mixers, presses, etc. Chemical & Process Machinery Corp., 52 Ninth Street, Brooklyn, N.Y., Phone: HY. 9-7200.

CONTINUOUS VACUUM FORMING SETUP: Including 3½" NRM model 50 extruder, 48" NRM sheeting die, brown 3-Roll polishing unit, brown 48" continuous vacuum forming machine, 2 rapid clickers, 1 thermo trim machine, and 24 houseware & toy vacuum forming molds. Best offer. Rosenberg Bros. & Co., Smithtown, N.Y.

FOR SALE: 1 oz. Van lever type—$850. 4 oz. Lewis, 1954—$3,000. 4/6 oz. R-P, 1955. 4 oz. vert. DeMattia. 8 oz. R-P, 1946—$5,000. 12 oz. W-S Model E—$6,000. 12 oz. Lester w/solid frame—$4,000. 16 oz. vert. Impco. 48 oz. W-S 1950 Model #246 Vactrim. Ovens, grinders, powder mixers, injection molding machines 1 oz. to 60 oz. never used and used. Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers, N.Y., YOnkers 5-0900, 102 Grove Street, Worcester, Mass. PLeasant 7-7747, 5222 W. North Ave., Chicago, Illinois, TUxedo 9-1328.

FOR SALE: 64 oz. Injection Molder with Pre-Plasticizer mold size 32"x50" 750 ton clamp. Lester 8 oz. Model 2½ L (1949). DeMattia 12 oz. (1946). DeMattia 4 oz. H.P.M. Rubber Injection molders, 21½" x28" mold space, steam heated platens. Watson-Stillman 300 ton semi-automatic compression molding press (1947) self-contained, mold size 34"x27". Watson-Stillman 250 ton 28"x24". Watson-Stillman 140 ton 22"x16". Waterbury Farrel 85 ton 20"x24". W.F. 63 ton 15"x15". Laboratory presses—15 ton 10"x8" and 10 ton 6"x6" platens. (2) 8 ounce Reed Prentice injection molding machines and (1) 8 ounce Lester Phoenix (late) with nylon attachment. Scrap cutters, valves, accumulators. Hydraulic Presses—all sizes. Aaron Machinery Co. Inc., 45 Crosby St., New York, N.Y. Tel.: WAlker 5-8300.

FOR SALE: (6) 100 ton, 10" ram, 10" stroke @ $1250; (7) 200 ton, 9" stroke, 14" ram, 36x36, @ $2160; (6) 200 ton, 9" stroke, 15" ram, 30x30 @ $1850; (1) ton complete, 18x18 @ $1850; (1) 200 ton 16" ram 30x30 @ $2460; (2) 200 ton 16" ram. 42x42 @ $2850; (1) 200 ton, 15" ram, 42x42 @ $2600; (3) 250 ton (2) 12" ram, 30x60 rebuilt @ $3675. Hydraulic Sal-Press Co., Inc., 386-90 Warren Street, Bklyn., N.Y.

FOR SALE: Late model L-2-8 Lester Injection molding machine. Like new, can be seen in operation in New York area. Reply Box 3900, Modern Plastics.

GOOD EQUIPMENT: At the right price. Falcon ribbon blenders in steel or stainless; NRM 2½" extruder, rotary cutters by Ball & Jewell, Sprout-Waldron, Abbe; Baker Perkins heavy duty dbl. arm mixers, 100, 200, 300 gal; French Oil Mill Hydr. press 450 ton; Blaw Knox S/S Resin Kettle 7'6"/7'6", Jktd. Agtd.: Sturtevant 300 cu. ft. Batch Mixer; Stokes and Colton Rotary and Single Pre-form Presses; Send for new First Facts, containing complete illustrated inventory; First Machinery Corp., 209 Tenth St., Bklyn 15, N.Y. Fred R. Firstenberg, Pres.

FOR SALE: 1 Baker Perkins 15USE, 100 gal. all stainless double arm Vacuum mixer; 1—Baker Perkins size 15VUUM, 100 gal. double arm mixer, 100 HP motor; 1—Baker Perkins size JNM 100 gal. double arm mixer; 6—Day 250 and 100 gal. double arm mixers; 1—Ball & Jewell #1 Rotary Cutter; 2—Two Roll Mills 6" x 12"; 6—Stokes model DD2, DS3, D3 and B2 Rotary Preform presses; 4—Stokes model "R" single punch Preform presses; Also: Sifters, Banbury mixers, Powder mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

Machinery wanted

WANTED: A 4-ounce injection machine. Must be in good running order. We will pay cash. Address all information to Roby Industries, 1709 Forest Ave., Dallas, Texas.

WANTED TO BUY: 2 used plastic extruders, 3½ or larger. Prefer NRM reliance drive, 20 to 1 barrel. Must be in good condition. Reply Box 3907, Modern Plastics.

WANTED TO BUY: Used injection machines and extrusion equipment. Reply Box 3908, Modern Plastics.

EXTRUDERS: 1½" & 3½" or 4½" complete with drive, must be in good condition and available for inspection. N.R.M. preferred but will consider others. Reply Box 3909, Modern Plastics.

WANTED TO BUY: Used injection molding machines, oven, granulators. One machine or complete plant. Acme Machinery & Mfg. Co. Inc., 20 South Broadway, Yonkers, N. Y. YOnkers 5-0900, 102 Grove Street, Worcester, Mass., PLeasant 7-7747, 5222 West North St., Chicago, Illinois, TUxedo 9-1328.

Materials for sale

FOR SALE: Hi-impact styrene, large quantities available in pastel shades, including pink, green, white, blue. Low prices. Success Plastics Corporation, P. O. Box 506, Indianapolis, Ind. Telephone: LIberty 6-2919.

(*Continued on page 244*)

NEW IDEA LAB

FOR RUBBER & PLASTIC

• This Process Laboratory in Akron, Ohio is a birthplace of new ideas in rubber and plastic. Here we develop basic machines, such as automatically operated mills and processing screw extruders to:

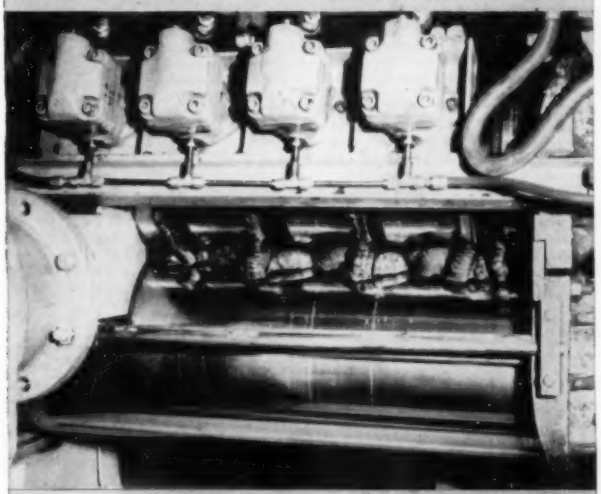
1. **Produce more products per man-hour.**
2. **Produce products of higher quality.**
3. **Produce products with new and different material formulations.**
4. **Produce new end products.**

New materials, new processes and new products require new machines and new thinking. Wherever your horizons lead you, this Laboratory could possibly supply some of the answers. Your new idea or idea yet to be born can mature here. Outline your thinking by phone or letter and we will go to work.

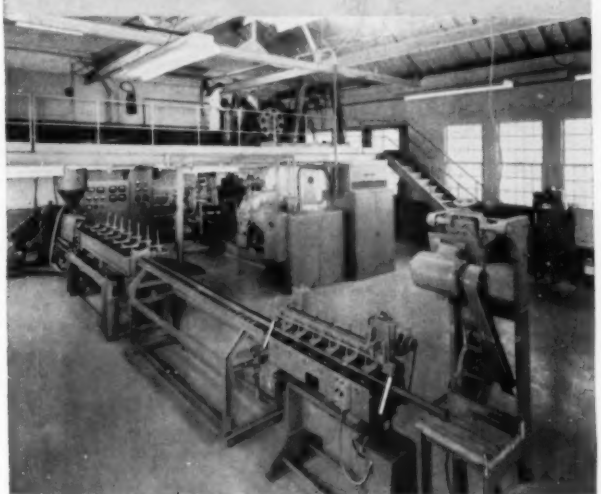
AETNA · STANDARD
ENGINEERING COMPANY
PITTSBURGH, PENNSYLVANIA

Sales and Engineering
HALE & KULLGREN, INC.
Akron, Ohio

Raw material handling may include blending, automatic weighing, and controlled feeding.



The Continuous Automatic Mill dispenses pigments and plasticizes uniformly without manual attention.



We specialize in screw machines for processing, blending, reclaiming, or devolatilizing.

(*Continued from page 242*)

FOR SALE: Virgin styrene—cut costs—save money. High impact: Natural, standard and special colors, pastels. Medium impact: Natural standard and special colors, pastels. General purpose: Crystal, all standard and special colors. Ask for our low price quotations. We will match your color needs. Erie Plastics Co., P.O. Box 1068, Erie, Pa. Phone 2-2503.

FOR SALE: 30,000 lbs. virgin natural medium impact styrene. 20,000 lbs. virgin pastel shades hi impact styrene. 25,000 lbs. virgin natural polyethylene. Also standard toy colors polyethylene. Low prices. Reply Box 3903, Modern Plastics.

Materials wanted

BUTYRATE WANTED: Urgent need for 22,000 lbs. butyrate. Virgin or scrap. Mixed or straight colors. Any flow. Reply Box 3910, Modern Plastics.

WANTED—VACUUM FORMED AND MOLDING SCRAP: Any Kind—Any Quantity. Contact us for Latest Quotations. Claude P. Bamberger, Inc. One Mount Vernon Street, Ridgefield Park, N.J., Telephone: HUbbard 9-5330.

WANTED: Plastic of all kinds—virgin, reground, lumps sheet and reject parts. Highest prices paid for styrene, polyethylene, acetate, nylon, vinyl, etc. We can also supply virgin & reground materials at tremendous savings. Address your inquiries to: Gold-Mark Plastics Compounds, Inc., 4-05 26th Ave., Long Island City 2, N. Y., RAvenswood 1-0880.

POLYETHYLENE SCRAP WANTED: Film, lumps, rejects, reground and surplus lots. Top prices paid. M. Koenig & Sons, Inc., 758 Humboldt Street, Brooklyn 22, N.Y. Telephone: EVergreen 9-1800.

PLASTIC SCRAP WANTED: From molders, vacuum formers, fabricators; acrylic, styrene, polyethylene, acetate, butyrate, etc. For top prices write, wire, phone collect. Philip Shuman & Sons, 15-33 Goethe St., Buffalo 6, N. Y. Tel: HUmboldt 1811.

Molds for sale

FOR SALE: Houseware molds, comb molds, also some novelty and specialty items. All in excellent condition. No reasonable offer refused. Send for list. Reply Box 3901, Modern Plastics.

Help wanted

SALESMAN WANTED: By firm now established but desirous of entering premix polyester field. Attractive situation for competent person. Reply Box 3911, Modern Plastics.

PLANT ENGINEER: Heavy experience in extrusion. Capable of operating blow molding plant. New York area. Salary commensurate with ability. Reply fully detailing experience and salary requirements. Reply Box 3918, Modern Plastics.

PLASTICS DESIGNER: Tool and mold. Should have experience in compression and injection molding. Excellent permanent position with large eastern manufacturer. Write in detail. Reply Box 3912, Modern Plastics.

SUPERINTENDENT: For sheet extrusion division. New modern plant and equipment in Michigan. Furnish complete resume of experience. Reply Box 3913, Modern Plastics.

MANUFACTURERS REPRESENTATIVES WANTED: To represent Miami company specializing in nylon parts. Must be familiar with molded plastics and should have some engineering background. Many areas available. Excellent opportunity. Reply Box 3916, Modern Plastics.

PLASTICS EXTRUSION: Technical man, to take complete charge of long established plant in metropolitan New York area. Must be thoroughly experienced in extrusion techniques on all thermoplastic materials. Must know die design set-up and production. Must be able to handle and train men. Salary commensurate with experience. State all qualifications and experience. Reply Box 3914, Modern Plastics.

INJECTION MOLDING HELP: Foremen, Leadmen, molders, maintenance men experienced on H.P.M. machines, opportunities galore in our expanding operation. We need top men. Pay will be commensurate with ability and experience. Loma Plastics, Inc., P. O. Box 11277, Fort Worth Texas. Att.: R. H. Copeland, Personnel Mgr.

WANTED—PLASTIC SALESMAN: Established Plastic reprocessor desires one Chicago-area, one Ohio & Indiana area, and one New England area Sales and Purchasing representative. No personnel in these areas now, so you will not be contacting your present employer. State all details. Replies confidential. Reply Box 3915, Modern Plastics.

JR. CHEMIST: With degree in Chemistry or Chemical Engineering and one year of experience in PVC processing. Write presenting details of education and work experience to: Salaried Personnel Dept. Seiberling Rubber Company, Akron 9, Ohio.

SALES REPRESENTATIVE: To handle line of phosphors that are added to plastics molding compounds to make phosphorescent compression and injection molded products. Must be well acquainted with artificial resin industry. Commission basis. Best quality products and low prices guarantee high earnings. Reply stating territory now covered, other lines being handled and experience. Write to manufacturer: Dr. H. Stamm K.G., Berlin-Schoeneberg (Westsector), Feurigstrasse 59, West Germany.

PLASTISOLS AND ORGANOSOLS—VINYL DISPERSIONS CHEMIST: One of the nation's foremost pioneers in the constantly growing field of vinyl dispersions presents opportunity for man experienced in the formulation of vinyl plastisols, organosols, etc., to head expanding department. Present established business and new product development gives you a chance to project your own thinking into custom formulations. Our company is not an extremely large one, and so individual effort does not go unrecognized, and to the right man, this opening carries a salary of approximately $12,000.

Send detailed resume of background and experience, knowing your application will be held in strictest confidence. Reply Box 3927, Modern Plastics.

MANUFACTURER'S SALES REPRESENTATIVES WANTED: New Jersey company with unusual precision skills in custom compression molding seeks expansion of market. Most territories available. Generous commissions. Write details of your organization. Reply Box 3917, Modern Plastics.

DISTRICT SALES MANAGER—MIDWEST—POLYVINYL CHLORIDE: Our recent plant expansion makes necessary the addition of a Midwest District Sales Manager who will become the nucleus for our expanding operation in that area. The man we seek will have several years experience selling, or serving in a technical capacity closely associated with the sale of P.V.C. This man may not be able to realize his full potential in present employment and will wish to take advantage of the opportunities offered by a new and expanding chemical operation. Send resume in full confidence to: T. A. Hoyle, The Borden Chemical Co., Polyvinyl Chloride Dept., 60 Elm Hill Ave., Leominster, Mass.

GENERAL MANAGER—PLASTICS: For one of Australia's largest industrial concerns to take charge of its plastic subsidiary companies consisting of three manufacturing branches. The products cover a wide range of injection, extrusion and compression methods. Total employees 500. Must have full knowledge of the plastic industry, proving ability to organize and control his production planning and the initiative to build up the plastic company by coordinating the three factories. Good prospects for a man between the age of 30 and 45 with unlimited opportunity in a companiy engaged in many activities. Location either Sydney or Melbourne. Car provided. Superannuation scheme. Advantage of Australia (California-type) climate. Good educational facilities for children. Accommodations provided and substantial salary offered. Apply in confidence to Australian Consolidated Industries Ltd., 1422 Oliver Building, Pittsburgh 22, Pa.

SALES ENGINEER: One of America's leading extruder manufacturers needs an experienced sales engineer to be located in the New York—New England area. This position offers excellent returns to a capable, experienced man. Our employees are advised of this advertisement. Reply Box 3919, Modern Plastics.

PERSONNEL: Executive — Technical —Sale—Production. Employers and Applicants—whatever your requirements, choose the Leader in Personnel Placement. Cadillac Associates, Inc., Clem Easly—Consultant to Plastics Industry, 220 South State, Chicago 4, Ill.—WAbash 2-4800. Call, write or wire—in confidence.

ASSISTANT PLANT SUPERINTENDENT: Chicago area corporation has an exceptionally fine position for a man with sheet extrusion and vacuum forming experience. This position is for a man qualified to handle production and personnel. Excellent opportunity for advancement. Salary commensurate with experience and ability. Inquiries treated confidentially. Reply Box 3904, Modern Plastics.

(*Continued on page 246*)

IMS PURE
SILICONE FLUID
MOLD RELEASE SPRAY

EXCLUSIVE, FAST,
ALL-METAL VALVE
ENDS FUMBLING
SAVES CYCLE TIME
Keeps Mold Lube Cost Down

It Isn't Size —
It's Performance and Quality That Count!

PRICES (Delivered)
Sample Can $2.00
Per Unbroken Dozen $18.00
Per Unbroken Gross $197.40

The Economical Way to Buy and Apply Pure, Costly Silicone Fluid!

To Cover All Molding Conditions Keep Both Types on Hand

IMS PURE
ZINC STEARATE
DRY POWDER SPRAY

HANDY MOLD DUSTER

Quick—Convenient

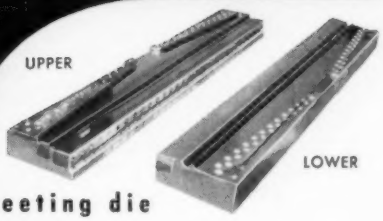
Removable, Cleanable Spray Head Directs Dust Into Cavity Without Waste.

PRICES (FOB Cleveland)
Sample Can $2.00
Per Unbroken Dozen $13.80
Per Unbroken Gross $144.00

IMS Mold Releases are designed to bring you maximum quality and performance. Our Silicone Fluid Spray utilizes only more costly volatile Freon to minimize part marking on fast cycles. The Dry Powder Spray should be used in all applications where painting or plating follows the molding operation, also in preforming.

INJECTION MOLDERS SUPPLY CO.
3514 LEE ROAD • WYoming 1-1424 • CLEVELAND 20, OHIO

Preferred and used
by the largest producers of plastic sheets



sheeting die

Featuring adjustable Die lip for production of sheets from .020" and heavier, plus adjustable Restrictor Bar assuring uniform material distribution, these highly polished, chrome-plated Dies produce a quantity and quality of product to meet the most exacting requirements. Drilled and tapped for pressure gauges and Thermo Couplings, the Die is equipped with bleed-off holes at either end . . . wired into heating zones with heat supplied by cartridge-type heaters . . . complete and ready to attach to your control panel.

DESIGNERS AND BUILDERS OF MODERN AUTOMATED PLASTICS EQUIPMENT

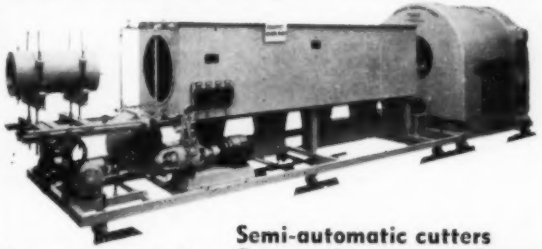
Goulding MFG. CO.
2929 RIVER ST. SAGINAW, MICH.

Costruzioni Meccaniche Cogliati

Machines and Plants for working Plastic Materials

Head Office: Corso Magenta 32—Phone 893902—MILAN—ITALY
Works and Offices: Via Montevideo 25 —Phone 482834

Injection presses
Special draggings for rigid PVC shaped materials with automatic syncronized cutting
Draggings for PVC rigid tubings up to a diam. of 540 mm.
Automatic tube cutters up to a diam. of 540 mm.



Patented Plant for gauging and cooling crawler-mounted dragging for rigid PVC tubings up to a diam. of 540 mm.

Semi-automatic cutters
Pneumatic presses and complete equipment for special PVC pieces
Coiler for coiling ribbons and flexible tubings

(Continued from page 244)

Situations wanted

IDEA MAN—CONSULTANT—DESIGNER of newly developed original processes, technical know how, and trade secrets in manufacture of rigid transparent structural sheet—decorative and industrial—available on consulting/royalty basis. Suggested production items include: building curtin walls, tub and shower enclosures, skylights, table tops, furniture applications, room dividers, highway signs, pearlescent sheet and button stock, 3-dimensional displays in "living plastic", etc. No limit to size sheet. Tremendous potential for large progressive company. Will consider association. Reply Box 3922, Modern Plastics.

SUPERVISORY CHEMIST AVAILABLE: 14 years development experience ranging from electrical insulation to rubber sundries. Intensive work with plastisols, organosols, coated fabrics, synthetic finishes, release compounds, adhesive cements, pressure sensitive tapes. Experience with natural and synthetic rubbers and with almost every type of available polymeric and resinous material. Reply Box 3920, Modern Plastics.

MANUFACTURERS AGENT: Sales manager for 9 (nine) years with plastics sales and manufacturing firm. Forming independent sales firm in Dallas-Fort Worth area. Will represent and pioneer new material for use in the Aircraft, electrical, chemical and oil industry. Will consider offers of protected territories only. Reply Box 3921, Modern Plastics.

POLYESTER: Technical man, 30, single, with good laboratory background and plant experience in polyester, desires supervisory or technical position in the reinforced plastic industry. Reply Box 3902, Modern Plastics.

Miscellaneous

WANTED TO BUY: Plastic ideas suitable for advertising specialties and premiums. Will buy molds and tooling outright or on royalty basis. Send information and prices. Reply Box 3926, Modern Plastics.

CANADIAN PROPRIETORY INJECTION MOLDER: With manufacturing facilities and cross-Canada distribution set-up, is interested in expanding present lines. Would welcome discussions with American Manufacturers of plastic infant lines, etc. Can also offer broad range of custom molding services on items that are being shipped to Canada by manufacturers who presently have no Canadian molding facilities. Reply Box 3923, Modern Plastics.

MERGER OR PURCHASE: Injection Molding Plant with machines to 12-oz. capacity. Tax loss desirable. Forward details of equipment and tax status. Reply Box 3924, Modern Plastics.

WELL KNOWN EXTRUSION PLANT: With ample finances and excellent record of performance desires further expansion through acquisition of additional extrusion plants throughout the country. Arrangements can be made for a complete or partial purchase of interested companies. Prefer to retain present management. All replies confidential. Reply Box 3925, Modern Plastics.

CAPITAL TO INVEST: Commercial and real estate financing. 1st & 2nd Mortgages. Construction loans. Chattel loans on machinery, equipment, fixtures & inventory. Sales & leaseback. Present financing consolidated and increased. Payments reduced. Receivable discounting. Re-discounting and installment financing. Long term subordinated note and debenture financing. New ventures financed. Promotional financing. Sy Field Co., 1457 Broadway, N. Y. WI 7-7395.

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Modern Plastics reserves the right to accept, reject or censor classified copy.

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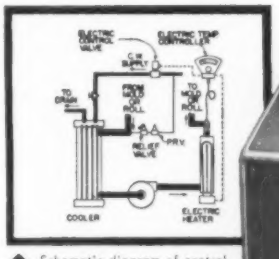


▲ Schematic diagram of control circuit in the Sarcotrol Model MC-1, Single Unit. Model MC-2, Dual Unit, is equipped with two of these circuits. Model MC-3 has three complete circuits.

Sarcotrol Model MC-2 Heating and Cooling Unit for injection molds, cylinders, rolls and drums. Fully enclosed. Easily seen, completely accessible control knobs. ▶

With Sarcotrol Automatic Temperature Control a dial setting gives you *quality control*, and helps to free your production from the problems of *sticking, shrinkage* and *crazing*.

Sarcotrol helps you step up output, and cut down rejects. New, higher cooling capacity makes the Sarcotrol suitable for calender rolls and large molds.

Write today for full Sarcotrol information and get the latest details on Sarcotrol Heating and Cooling Unit, plus new specifications. 5893 F

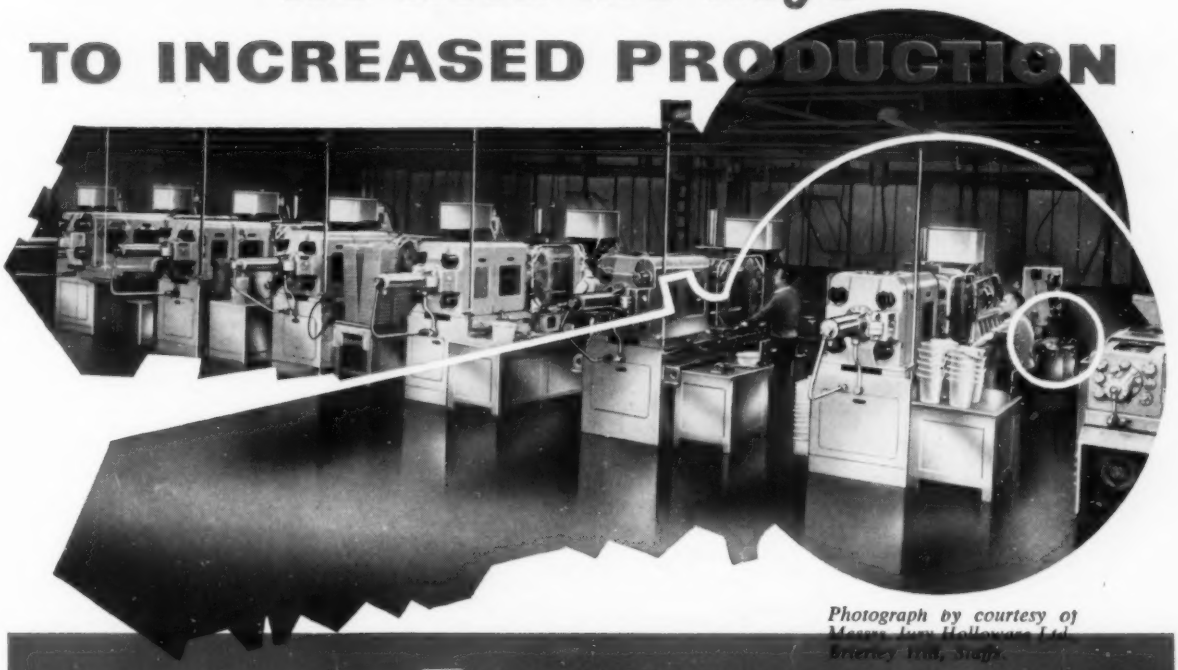
SARCOTROL GIVES YOU 8 MAJOR ADVANTAGES

1. Single knob adjustment of simple, selective control
2. Automatic 3-stage temperature control system
3. Recirculating, pressurized water system
4. Heat exchanger cooling adjustable to load
5. Higher temperatures — by controlling pressures
6. New economy of electricity and water
7. Sensitive system reaction — fast response
8. Automatic maintenance of correct temperature to protect product quality

SARCO COMPANY, INC. 635 Madison Ave., New York 22, N. Y.

TEMPERATURE CONTROLS • STEAM TRAPS • STRAINERS • HEATING SPECIALTIES

we hold the keys
TO INCREASED PRODUCTION



Photograph by courtesy of Messrs. Jury Holloware Ltd., Brierley Hill, Staffs.

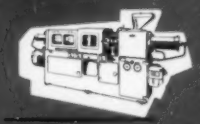
SH4
Injection Moulding Machine with a weight shot capacity of 4 ozs.

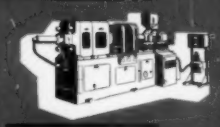
W20
Injection Moulding Machine with a weight shot capacity of 5-7 ozs.

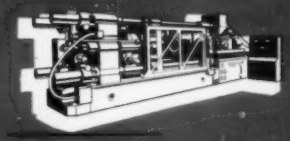
AP2088
Injection Moulding Machine with a weight shot capacity of 64 ozs.

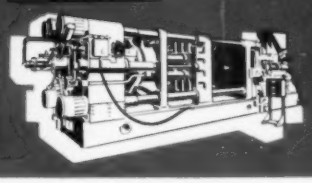
AP120
Injection Moulding Machine with a weight shot capacity of 90 ozs.

AP335
Injection Moulding Machine with a weight shot capacity of 210 ozs. (Polystyrene)









In the above illustration a battery of Windsor AP1044 'Autoplas' Injection Moulding Machines is seen in operation at a well known company's works.

Behind every Windsor model, from prototype to production line, is the long experience in design and method which has made Windsor the first name in plastics engineering. The unique pre-plasticising type machines shown above are built with Windsor precision from quality materials, to stand up to long years of hard service.

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- *Plasticising capacity, 120-140 lb per hour 300 tons clamping force
- *160 square inches projected area
- *44 cubic inch capacity, equal to approximately 32 ounces of cellulose acetate

**Dependent on mould construction and materials*

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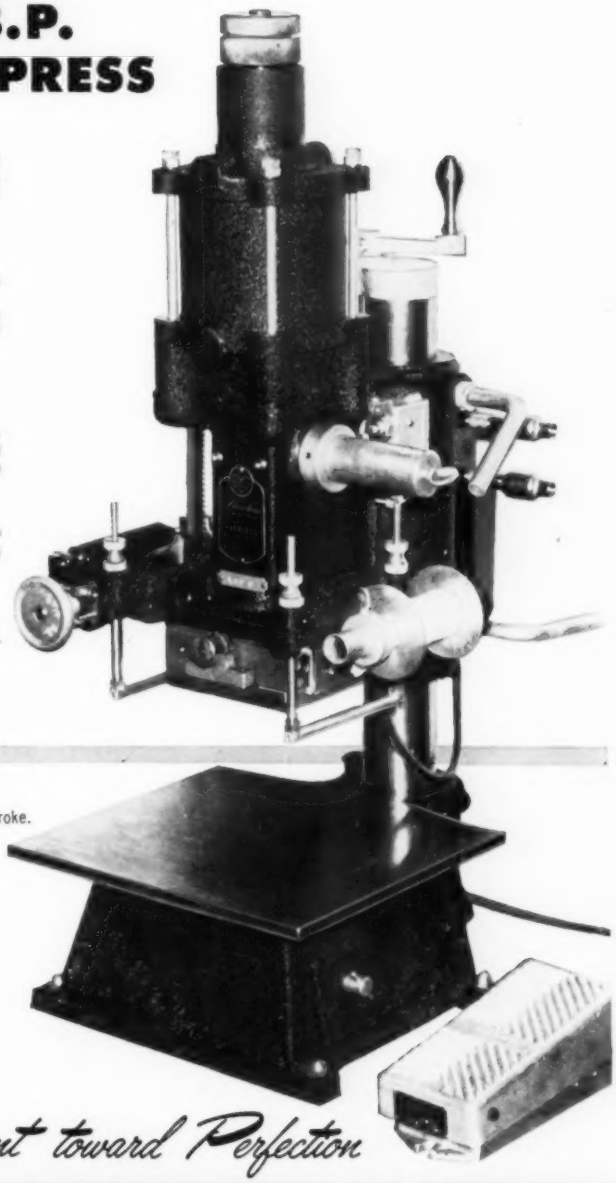

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SIZE:
15" wide x 19" deep x 36" high. Depth of throat opening 6" from center of head. 5" maximum opening from die plate to table. 2" stroke.

STATIONARY TABLE:
12" x 11"

AIR PRESSURE:
Not less than 2 h.p. compressor — 80 lb. pressure equipped with 60 gallon tank. Compressor not supplied.
Pressure approximately 19 times line pressure.

ELECTRICAL:
110 volts A.C., unless otherwise specified.

SHIPPING WEIGHT:
220 lbs. Net, 270 lbs. Gross
Head size: 4" x 5"
Die plate size: 4" x 5"
Chase size, inside: 3" x 4"

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lubricator, regulator, strainer and 6 ft. of hose.

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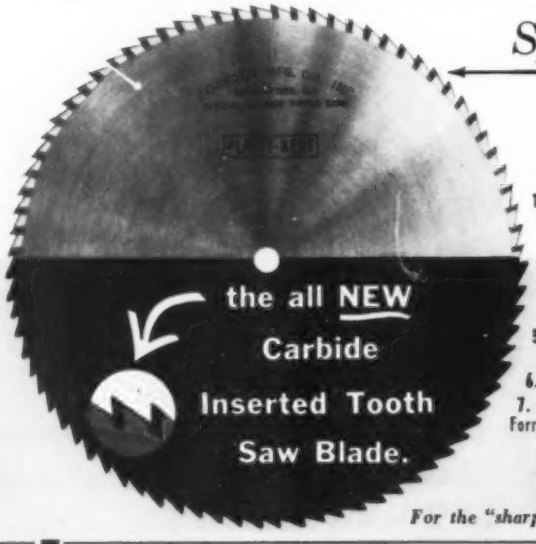

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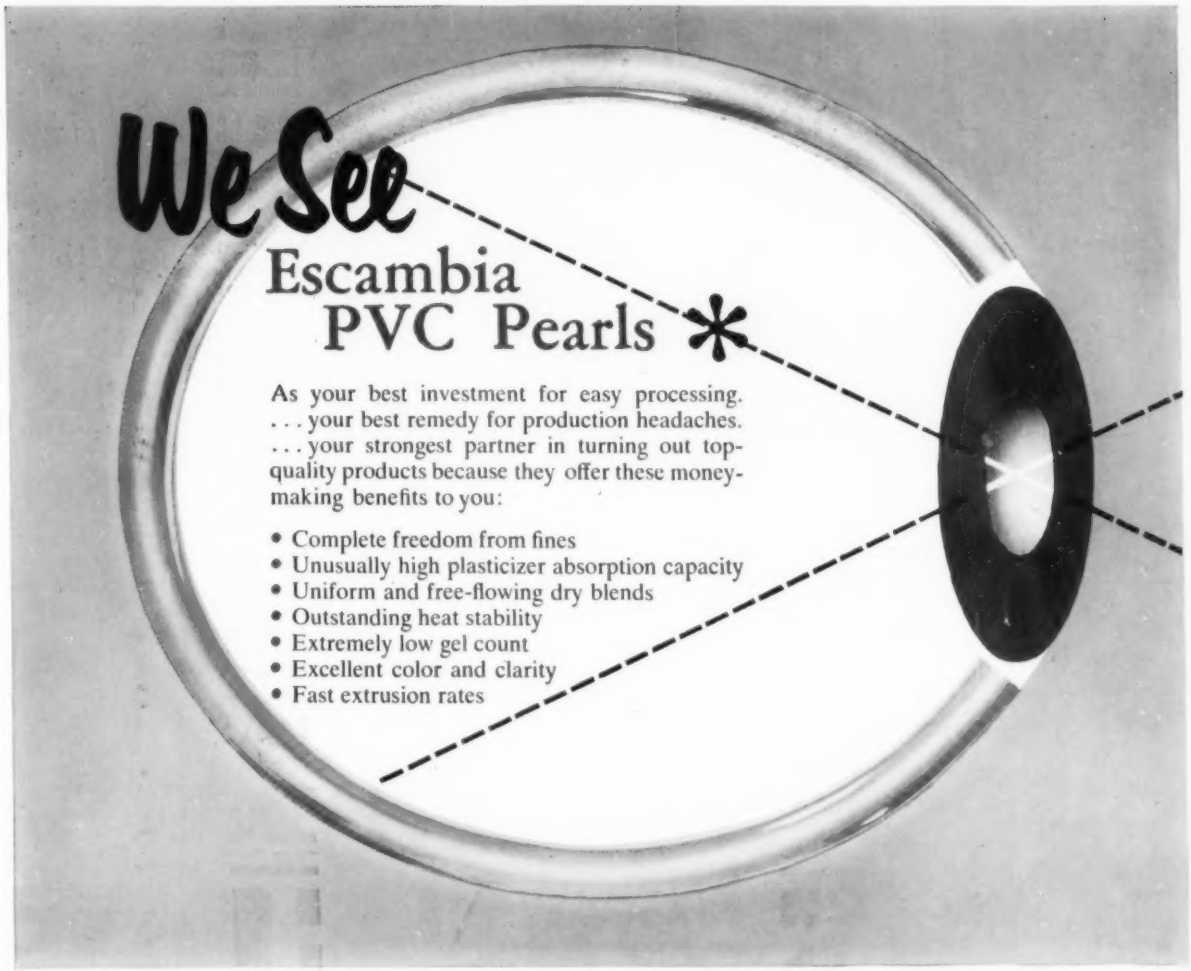
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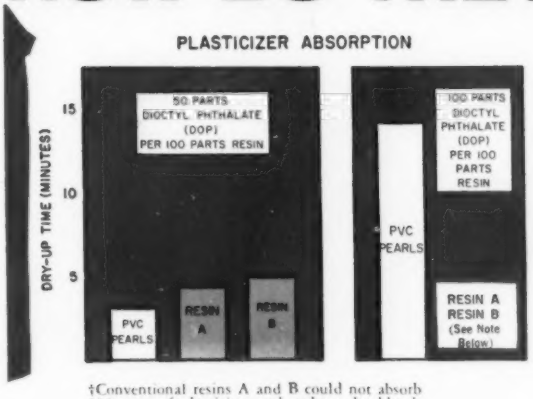

†Conventional resins A and B could not absorb 100 parts of plasticizer and make a dry blend.

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EXAMPLE

	(Parts by Weight) Control	Flame Retardant
Polyester Resin	100.00	100.0
Chlorowax 70	—	12.5
Antimony Trioxide	—	12.5
Luperco ATC	2.0	2.0
Colored Pigment	as required	
3-oz Glass Mat	60.0	60.0
Flexural Strength psi, Dry 1	26,000	27,500
Flexural Strength psi, Wet 2	24,000	25,000
Tensile Strength psi, Dry 3	15,000	15,700
Tensile Strength psi, Wet	14,000	14,300
Flame-Out Time, Seconds 4	Burns	1

METHODS OF TESTING

1. Flexural Strength — ASTM-D650-42T
2. Water Immersion — 7 days immersion at room temperature
3. Tensile Strength — ASTM-D638-46T
4. Flammability Test — ASTM-D635-44 — Test specimen 1″ x 6″ x 3/32″ is suspended horizontally at 45 degree angle so that 1″ of the specimen is exposed in a 5″ (1-1/2″ blue core) flame from a Bunsen burner. The sample is exposed 30 seconds and then the flame is removed. To be classed flame resistant the sample must be self extinguishing in less than 20 seconds.

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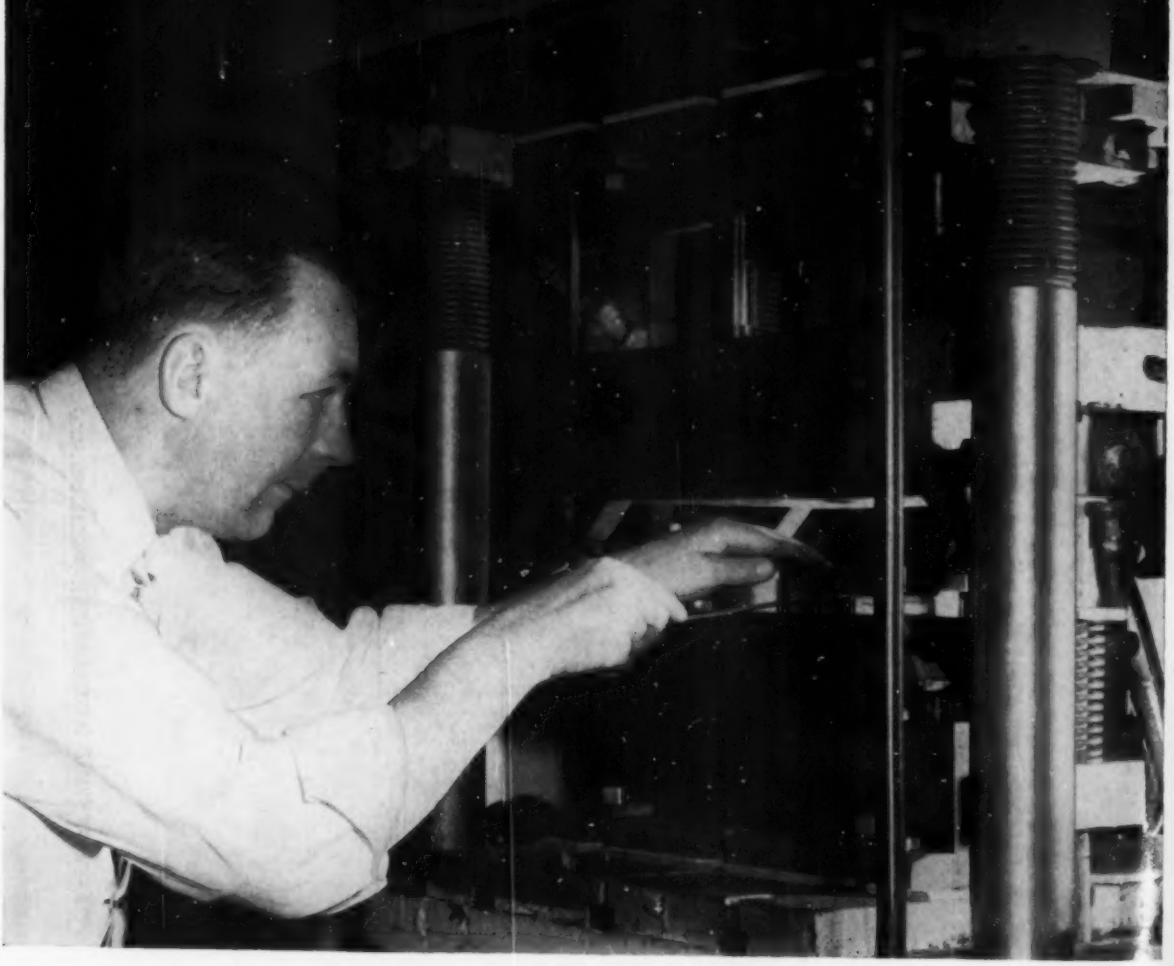
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